MODERN Machine Shop

A Magazine for Machine Shop Executives
HOWARD CAMPBELL, Editor

Vol. 4 JANUARY, 1932 No. 8

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Guaranteed circulation this issue, 27,500 copies

Published Monthly at 128 Opera Place, Cincinnati, Ohio.
DON G. GARDNER, President and General Manager

GEORGE H. MEYERS, *Western Manager*, Chicago
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MODERN Machine Shop

JANUARY, 1932

CINCINNATI, OHIO VOL. 4, NO. 8

Building the Hamilton Watch, I

A discussion of some of the tools and methods used in the construction of the modern time-piece.

By HOWARD CAMPBELL

IN the center of a thirteen-acre park at Lancaster, Pennsylvania, stands the huge building which Christopher Morley calls the "Capitol of Time." Here, in this building that in size, appearance, and personality resembles a university, are Hamilton watches made. Here some 1,200 people—experts at their appointed tasks—are employed in the daily production of from 600 to 700 watches of various sizes and shapes.

The modern watch consists of approximately 178 pieces, the making of which involves some 1,500 operations. All the parts in the mechanism of a watch are comparatively small, and those in a wrist watch are particularly so. In fact, some of the holes in a wrist watch are drilled with a drill of smaller diameter than the graduation on an ordinary steel scale, and these holes are tapped with a tap on which the threads are difficult to see with the naked eye.

It is reasonable to expect that a plant in which the work and tools are of such fine—and often minute—construction would be as clean as the proverbial whistle, and so this plant is. Not only must the quality of the watch mechanisms be safeguarded by the use of parts and tools that are as clean as possible, but untidiness must be avoided in order that the cost of production may be kept as low as possible. Some of the parts in a fine watch are so small that whole piles of

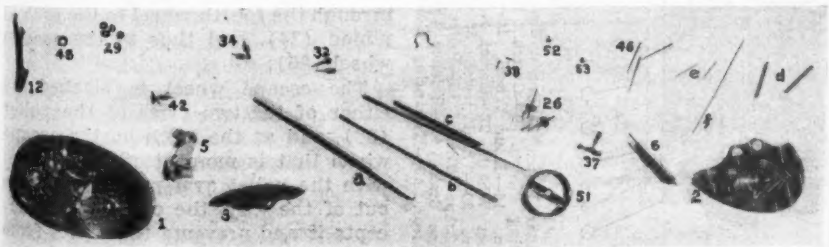


Fig. 1—Parts of the mechanism of a wrist watch movement, photographed actual size, together with some of the drills and plug gages.

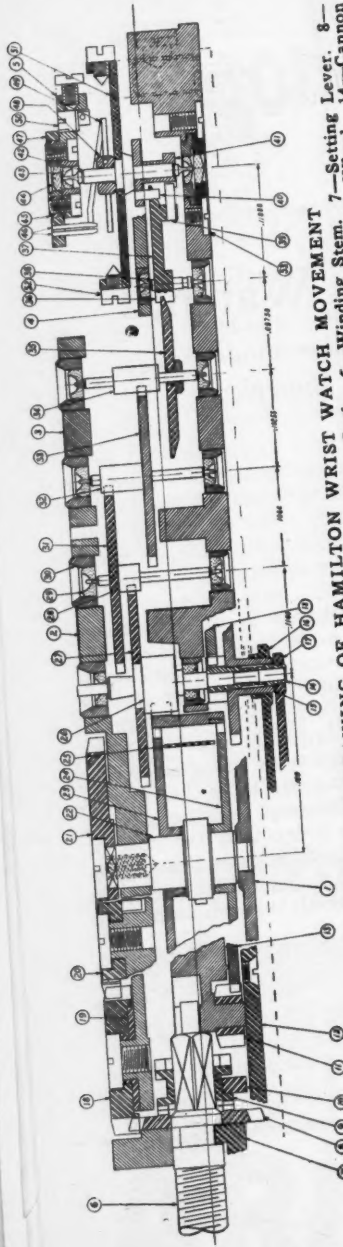


Fig. 2—CROSS-SECTION DRAWING OF HAMILTON WRIST WATCH MOVEMENT

1—Pillar Plate. 2—Barrel Bridge. 3—Train Bridge. 4—Pallet Bridge. 5—Balance Cock. 6—Winding Stem. 7—Setting Lever. 8—Winding Pinion. 9—Clutch. 10—Clutch Lever. 11—Intermediate Wheel. 12—Setting Cap Spring. 13—Minute Wheel. 14—Cannon Pinion. 15—Hour Wheel. 16—Minute Hand. 17—Hour Hand. 18—Winding Wheel. 19—Winding Wheel Hub. 20—Click. 21—Ratchet Pinion. 22—Barrel Arbor. 23—Barrel. 24—Barrel Cap. 25—Mainspring. 26—Center Staff. 27—Center Wheel. 28—Third Pinion. 29—Third Jewel. 30—Third Wheel. 31—Third Arbor. 32—Fourth Pinion. 33—Fourth Wheel. 34—Escape Pinion. 35—Escape Wheel. 36—Pallet Stones. 37—Pallet. 38—Pallet Endstone. 39—Guard Pin. 40—Roller Jewel Pin. 41—Double Roller. 42—Balance Staff. 43—Balance Collet. 44—Balance Jewel. 45—Balance Upper Nedstone Cap. 46—Regulator Pins. 47—Regulator. 48—Hairspring. 49—Hairspring Collet. 50—Hairspring Stud. 51—Balance. 52—Balance Screw. 53—Cap Jewel Screw.

them could easily be lost in any accumulation of dirt or shavings.

Every person in the manufacturing organization carries a jewelers' eyeglass. Those who are employed at the benches or machines wear theirs attached to pieces of spring wire, coiled around the back of the head so that the glass may be held over the eye or up on the forehead without difficulty. In order to increase visibility, the tops of the assembly and inspection benches are covered with sheets of clean white paper. And the papers are changed at regular intervals.

The mechanism of a watch is generally known as the "movement," and the system of gears and wheels is called a "train." A cross-section drawing of the train of a Hamilton wrist watch is shown in Fig. 2. The train is housed in the pillar plate, indicated as (1) in both Fig. 1 and 2. The pillar plate carries the bearings for one end of each of the shafts, the bearings for the opposite ends being carried in the barrel bridge (2), the train bridge (3), the pallet bridge (4), and the balance cock (5).

The train is actuated by the mainspring, which is anchored in the "barrel," indicated on the drawing as (23). When wound, the spring sets up a tension that is imparted, by means of the teeth on the barrel, to the pinion on the center staff (26), thence through the center gear wheel (27) to the third pinion (28), through the third wheel to the fourth pinion (32), through the fourth wheel to the escape pinion (34), and thus to the escape wheel (35).

The escape wheel is blocked by either of the two arms of the pallet (36), and as the tooth on the escape wheel that is momentarily in contact with the pallet arm pushes that arm out of the way, the other arm intercepts it and prevents the wheel from revolving continuously. Thus the escape wheel moves a fraction of a revo-

lution at a time, being alternately blocked by the pallet stones. The length of time that each arm, in turn, remains in interference with the escape wheel is determined by the tension applied by the coiling and uncoiling of the hair-spring (49) in the balance wheel (51).

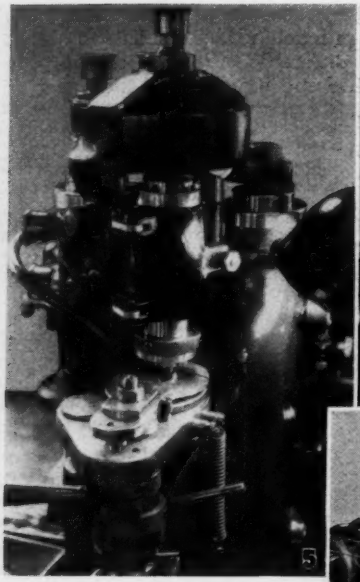
Fig. 3—View of the "model room," where new watch designs are developed.

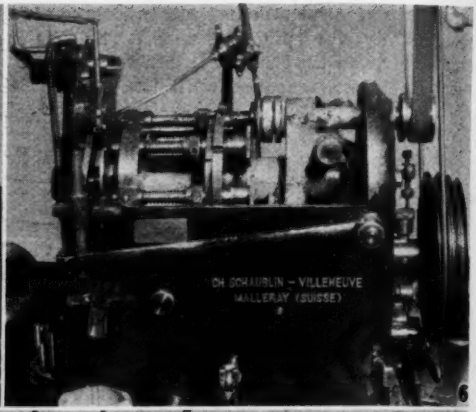
When a watch of new design is to be placed on the market, the finished drawings for the new watch are turned over to a corps of expert model-makers in the model room, Fig. 3. Here the first watch is made, each part being made by hand. The first, or model, watch of a new series usually costs around $4,000. When the model is completed, all center distances are carefully checked by the use of the instrument shown in use in Fig. 4. With the movement lightly clamped in position, the microscope is moved from one center location to the next and the reading is taken from the graduated collars on the screws. This instrument is accurate within 0.00005 inch.

The largest single piece in the movement is the pillar plate, indicated in Fig. 1 and 2 as (1). This piece is blanked from strip stock. The piece is then machined on one side to obtain five different surfaces of varying heights and diameters, which is done with the Hauser automatic vertical profiling machine shown in Fig. 5. The pillar plate is held by a spring chuck while a fine profiling tool performs the operation, the movement of the tool being controlled by a cam-action mechanism which is entirely automatic. The dimensions between faces must be held to within 0.0005 in. One operator runs three machines, each of which produces 900 pieces on this operation in eight hours.

In the next operation on the pillar plate, the piece is chucked in the horizontal eight-spindle drilling machine shown in Fig. 6, and 20 holes are drilled from one side. After the machine has been loaded and started, the

Fig. 4—Checking center distances on a model watch. This instrument is accurate within 0.00005 inch.





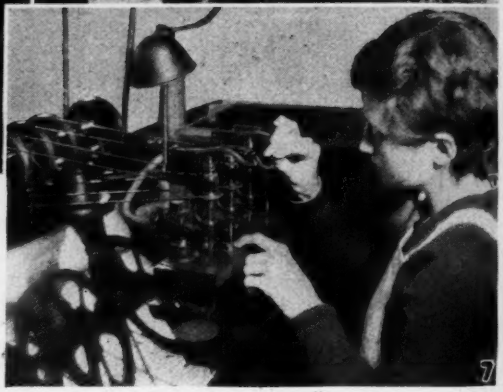


Fig. 5—Five surfaces of different heights and diameters are machined in the pillar plate with this machine. Fig. 6—This machine drills 20 holes in the pillar plate, one hole at a time, in less than one minute. Fig. 7—Counterboring holes in the pillar plate.

operation is automatic. As the barrel, carrying the spindles, indexes to bring the next tool into position, the workhead adjusts itself to align the location of the next hole with the spindle, the stop-plate indexes to provide the correct stop for the operation, and the spindle is locked to the spindle-sleeve so that power may be provided for drilling and feeding. The 20 holes are drilled in less than one minute.

Several of these holes must be counterbored from the opposite side of the piece, so in the next operation each piece is reversed and the holes are counterbored to varying depths and diameters by the use of the sensitive bench drill shown in operation in Fig. 7. The counterboring tools are guided by pilots which enter the holes that were drilled from the opposite side.

In Fig. 8 is shown the operation of facing one side of the barrel bridge, indicated as detail (2) in Fig. 1 and 2. This operation is performed in a double-head semi-automatic lathe, thus making it possible for the operator to unload and load one chuck while the other is in operation. Spring-chucks are used, the jaws of each chuck being controlled by a foot-lever. As each piece is chucked, the operator pulls a lever that starts the spindle revolving and the tool rest feeding to-

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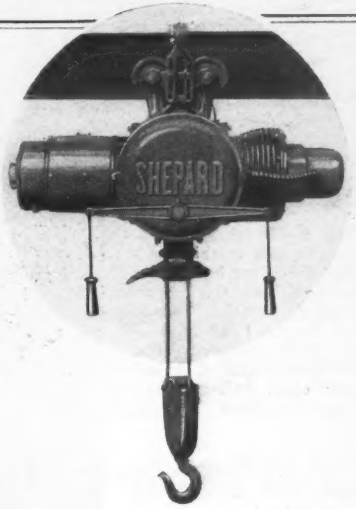

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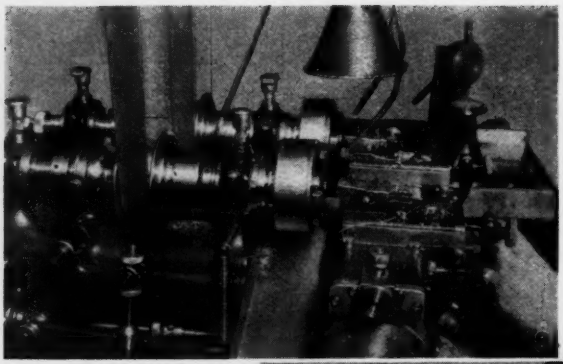

Fig. 8—Barrel bridges are faced in this machine at a rate of 500 per hour. Fig. 9—With this Gorton engraving machine, letters and figures 1/64 in. high are easily engraved. Fig. 10—Photograph of a balance cock, enlarged six times.

ward the work. The tool rest moves by rapid traverse to feeding position, the tool feeds across the face of the work, the tool rest recedes from the work, and the machine stops. The production on this operation is 500 pieces per hour. Pillar plates and balance cocks are also faced in this machine.

The barrel bridge in a Hamilton watch carries the number of the grade of the watch, the individual number of the movement, and figures giving the number of jewels in the movement. These letters and figures are engraved in the piece by the use of the Gorton engraving machine shown in Fig. 9. The operation of this machine is based on the "pantograph," by which the movement of the stylus over the pattern is reproduced, on a scale of 1:16, by the tool on the work. (The range of the machine is from 3:1 to 100.1.) Thus by moving the stylus over letters that are approximately ¼ in. high, the tool is made to engrave letters of corresponding shape and design but only 0.015 in. high, in the face of the workpiece. The graduation from "F" to "S" on the balance cock and the legend "Hamilton, U. S. A." on the train bridge are also engraved with a machine of this type. A balance cock, photographed with a microscope camera that enlarges the image 6:1, is shown in Fig. 10. This piece is also shown, actual size, in Fig. 1, and is indicated as (5) on the drawing Fig. 2.

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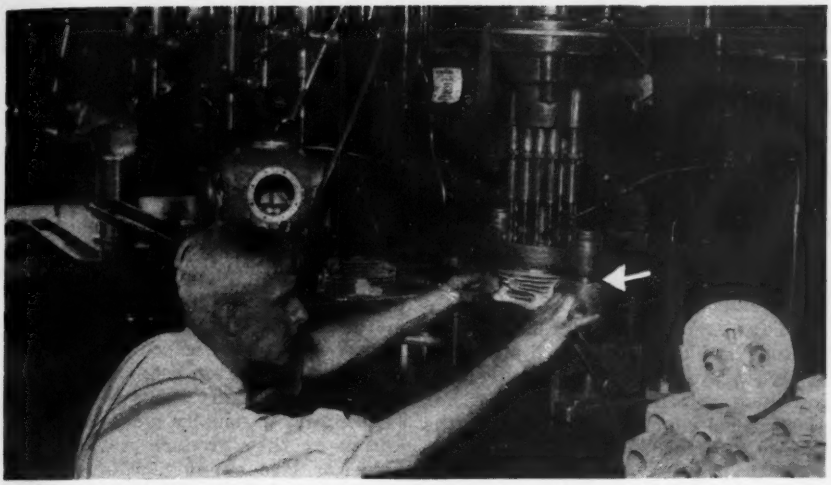
(Continued in the February issue.)



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R metal cutting

Characteristics of Alloy Steels, II

Effects of alloying elements—heat treatment of alloy steels—properties and treatment of high speed steels.

By GEORGE M. ENOS
Assistant Professor of Metallurgy, University of Cincinnati

NICKEL is an important alloying element in alloy steels that are used for certain purposes, but its use in tool and die steels is limited. It is generally used in these steels in combination with chromium. It has the general effect of strengthening the ferrite of the steel, and lowering the critical ranges. In Table II a summary of the effects of nickel, considered as the only added element, is given as well as the effects of certain of the other common alloying elements.

Chromium is one of the most important alloying elements used in tool and die steels. As little as one-half of 1 per cent of chromium prevents the precipitation of carbon in a free state in high carbon tool steels. Chromium has the power to dissolve in the iron and also form a carbide. It tends to make the transformation sluggish, thus raising the critical range to which steel must be heated before quenching and lowering it on cooling.

The addition of 1 to 2 per cent of chromium increases the wear resistance and hardness. From 3 to 4 per cent of chromium produces a steel suitable for some hot working operations and also for permanent magnets. When the chromium content is raised to from 12 to 16 per cent with a moderate carbon content, its ability to resist corrosion is greatly increased. The range of chromium from 10 to 20 per cent with a very high carbon produces a die steel with great wear resistance.

Vanadium is the most expensive of the alloying elements, but in most cases only a small percentage—about .2 per cent—is necessary to greatly improve the steel, especially from the standpoint of grain refinement. While carbon-vanadium steels are useful, chromium is usually used with vanadium as they produce a tool or die steel of excellent quality.

Tungsten forms carbides, and if no carbon is present it does not greatly affect the iron. Tungsten increases the hardness of the steel and also the fineness of the grain. Like chromium, it has a strong effect on the critical points. But the effect of tungsten on the critical points is varied by the percentages of tungsten and carbon, by the temperature from which cooling starts, the time held at the highest temperature reached, and the rate of cooling.

High speed steels contain tungsten, chromium, and vanadium, but discussion of high speed steels will be deferred.

The tungsten content in tool and die steels (other than high speed) ranges from .5 to 20 per cent, the range for high speed steels being above 12 per cent. When only a very small amount is used, it is merely to obtain extra hardness in a carbon tool steel. With slightly higher percentages, say from 1 to 2½ per cent, the tool steels have increased wear resistance and will have keen cutting edges. Such steels are particularly adaptable for making punches and chisels. Finishing tools often con-

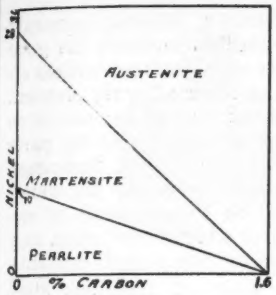


FIG. 5

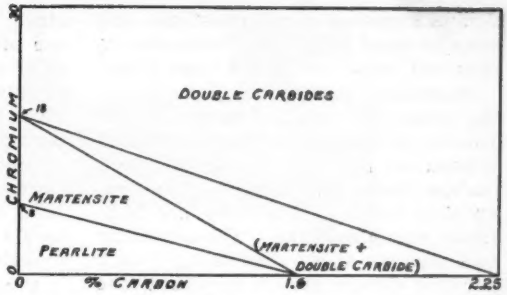


FIG. 6

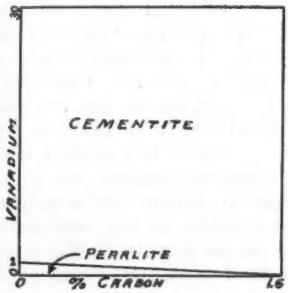


FIG. 7

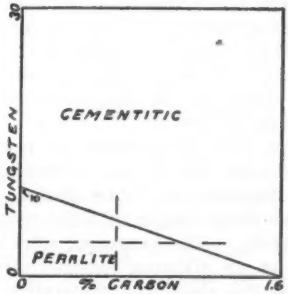


FIG. 8

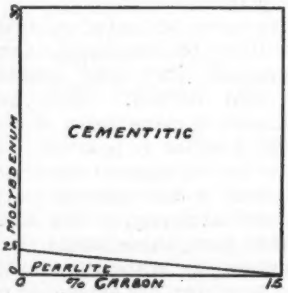


FIG. 9

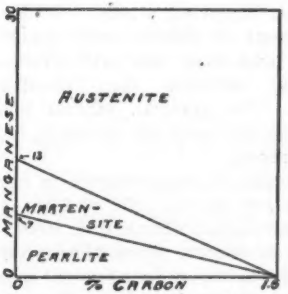


FIG. 10

Fig. 5 to 10—Diagrams illustrating the structures of the simple alloy steels in the fully-annealed condition.

tain from 3 to 6 per cent of tungsten with 1¼ per cent of carbon. Hot working die steels require 8 to 11 per cent tungsten. The higher percentages of tungsten tend to prevent warpage at high temperatures and hence 10 to 15 per cent tungsten may be used in certain valve steels.

Molybdenum resembles tungsten in many characteristics, but can only be used up to 3 or 4 per cent because of manufacturing difficulties. Molyb-

denum increases shock resistance and may be used with other elements in dies and tools, but is not used alone.

Manganese is found in all steels, being added for various reasons as previously mentioned. When increased beyond the percentages usual in plain carbon steels, the steel is, of course, an alloy steel. Manganese is a relatively cheap material. Oil-hardening tool and die steels containing 1 to 2 per cent manganese are produced. The intermediate ranges of manganese steel are not produced commercially, but steels containing 8 to 13 per cent manganese and 1¼ per cent carbon (Hadfield's steel) are particularly resistant to abrasion. Such steels are widely used for crusher jaws or for similar purposes.

Silicon, like manganese, is present in practically all steels. When present in amounts of more than .4 per cent, the steel comes into the class of alloy steels. The principal effects of silicon as an alloying element are to increase the electrical resistance and to tend to throw carbon out of solution. Silicon and manganese are used together in spring steels. From 2 to 4 per cent of silicon with other elements held very low will produce a material suitable for transformer sheets. In general, silicon has no value as an alloying element in tool or die steels.

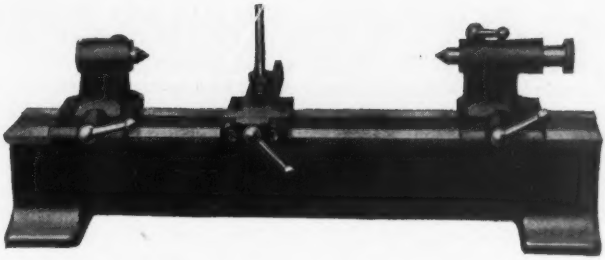
It should be remembered, in considering alloy steels, that carbon is the most influential element in steel. Variation in carbon percentage produces greater variation in physical properties than any other element, and also has the ability to change the location of the critical range greatly. Hence even in alloy steels the effect of varying the carbon content must not be overlooked.

In Table II the effects of the alloying elements have been summarized, each element being considered as being added by itself to the plain carbon steel. Obviously, alloying elements are often added to increase the good effects or decrease the undesirable effects of some other alloying element. Thus chromium and nickel are often used together in the ratio of 2½ parts of nickel to 1 part of chromium. Chromium-vanadium steels are widely used, and so on to groupings of elements to form alloy steels which may include four or five added elements.

From a study of diagrams given as Fig. 5 to 10, the structures of the simple alloy steels in the fully-annealed condition may be predicted. Thus Fig. 8 indicates that a tungsten-carbon steel containing .7 per cent carbon and 4. per cent tungsten, cooled slowly from above the critical range, would result in a pearlite structure. Now if either the carbon content or the tungsten content, or both, be increased to a point where perpendicular lines erected at the composition per cent on each axis would intersect in the field marked "cementitic," we should expect to find that the steel would contain free carbides and be considerably harder.

This same method of calculation applies to all the diagrams. Consider a manganese alloy steel containing .7 per cent carbon. With low percentages of manganese, slow cooling would produce a pearlitic structure, but if the manganese were increased, the steel would become martensitic, or "air-hardening." The addition of further manganese would change the structure to austenitic, making the steel less hard, but extremely resistant to wear. The diagrams shown are subject to criticism on theoretical grounds, but they make possible a prediction as to structures, and hence physical and mechanical properties, on slow-cooled steels.

It is beyond the scope of this article to discuss in detail the various heat treating operations for the many com-



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mon alloy steels. The recommended practice for heat treating steels for specific purposes, as well as the selection of the steels from among those available, is considered in detail in many standard references, and particularly in the National Metals Handbook.

High Speed Tool Steels

High speed tool steels are used so extensively, because of their peculiar properties, that they are here considered separately from the tool and die steels previously discussed. A high speed steel is any one of a group of steels which have the property of retaining their hardness and shape at a dull red heat. In other words, high speed steels retain their cutting efficiency at speeds and feeds which would quickly dull ordinary tool steels. There are many brands of high speed steel on the market, but they can be grouped into three general classes of analyses as follows:

Class I. Carbon, .55 per cent; tungsten, 18 per cent; chromium, 4 per cent; vanadium, 1 per cent; commonly called the 18-4-1 type. Variations in percentages and additions of other elements may be made in slight amounts without greatly disturbing the 18-4-1 ratio.

Class II. Carbon, .55 to .75 per cent; tungsten, 14 per cent; chromium, 4 per cent; vanadium, 2 per cent; commonly called the 14-4-2 type.

Class III. Class I steels with the addition of cobalt, sometimes called "super" high speed steels.

It will be noticed that all three types contain, as essential features, a definite range of carbon, about 4 per cent of chromium, and vanadium from 1 to 2 per cent.

These are the modern types of high speed steels. It may be of interest to recall that it is only about sixty years since Mushet discovered that the addition of tungsten to steel conferred air-hardening properties, and only about thirty years since the classical investigations of Taylor and White revealed that high-tungsten steels could be and should be heated to much higher temperatures than had been customary, in order to secure best results.

High speed steels are made by the crucible or electric furnace processes. Considerable care is necessary in the melting and casting, and extreme care must be taken in the hot working in order to secure satisfactory stock.

The effects of the various elements in high speed steel may be summarized as follows: Tungsten obstructs or retards the transition from one constituent to another both on heating and cooling, and thus tends to "fix" the hard constituent—martensite—formed after quenching. It also increases the hardness due to the formation of the double carbide of iron and tungsten.

Chromium greatly increases the "secondary hardness," which is obtained by tempering at high tempering temperatures. It is a hardening agent, and also effects a marked lowering of the temperature at which the hardening can be done.

Vanadium is of general benefit, due to the fact that it is a scavenger in the steel-making process. It tends to produce a fine grain, and can be substituted to a limited extent for tungsten (Class II) since it increases the "red hardness." It cannot be increased above 2.5 per cent, however, without preventing the steel from hardening properly.

Cobalt is used up to 9 per cent, usually to increase the toughness, but its action is not very well understood. For certain uses, such as cutting cast iron, the efficiency seems to be increased. Cobalt is an expensive metal, however, and there is no agreement as to just how much should be used. It is doubtful whether the increased efficiency of "super" high speed steels in certain fields will offset the added

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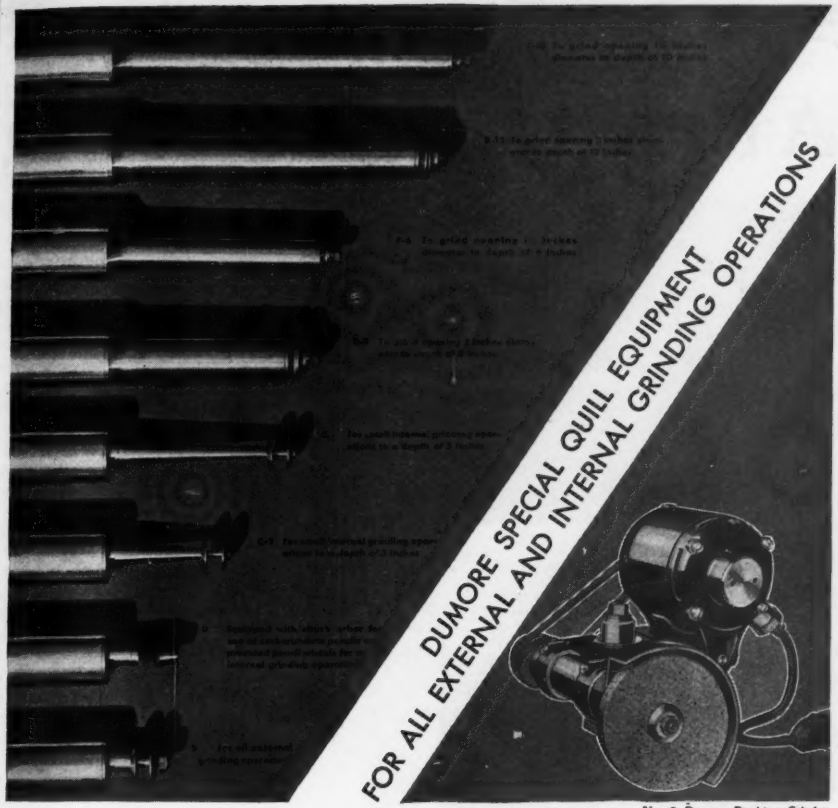

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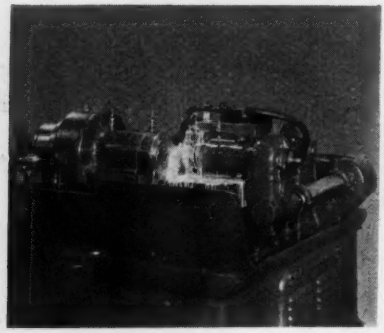
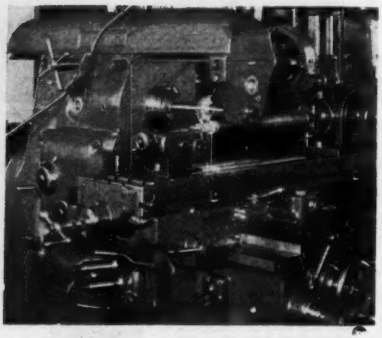
Aids in Reducing



Courtesy of Producto Machine Co., Bridgeport, Conn.

PART: BRAKE CAM.
OPERATION: PROFILING.
MACHINE: 12-C "PRODUCTO-MATIC" CAM MILLER.
STOCK REMOVED: ¼ INCH.
CUTTER: 2¼ INCH PRODUCTO CUTTER.
CUTTER R. P. M.: 320.
TIME PER PIECE: 55 SECONDS.
LUBRICANT: 1 PART SUNOCO TO 40 PARTS WATER



Courtesy of Cincinnati Milling Machine Co., Cincinnati, Ohio

OPERATION: MILLING KEYWAY ON SHAFT.
MACHINE: NO. 2 CINCINNATI MILLING MACHINE.
MATERIAL: STEEL FORGING
CUTTER: 4 INCH—51 R. P. M.
FEED: 3½ INCH PER MIN
WIDTH OF CUT: ⅝ INCH.
DEPTH OF CUT: ⅞ INCH.
LUBRICANT: 1 PART SUNOCO TO 20 PARTS WATER.

The increasing necessity for lower production costs places upon machine shop executives the obligation of selecting cutting lubricants of known quality and proven worth.

Economical operation and profit are dependent upon continuous, uninterrupted machine tool performance.

Accurate, quantity production with high speed machine tools requires the application of the proper feed and speeds, simplified and effective tooling and the selection of a cutting lubricant which will insure full machine tool capacity.

While the selection and application of cutting lubricants may be considered by many executives as just a detail, (because such items represent but a small percentage of cutting costs) nevertheless cutting lubricants exert a suprisingly important influence upon the ultimate cost of production.

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SUN OIL COMPANY, Philadelphia, U.S.A.

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Manufacturing Costs

Increased machine speed, longer runs per tool grind, less lost time for resetting, reduced tool maintenance, greater accuracy and better finish are the reasons for the increasing use of Sunoco by the automotive industry, nut and bolt industry, gear manufacturers and steel plants.

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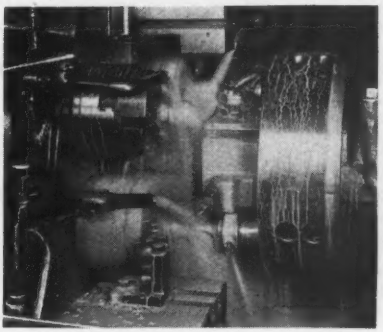
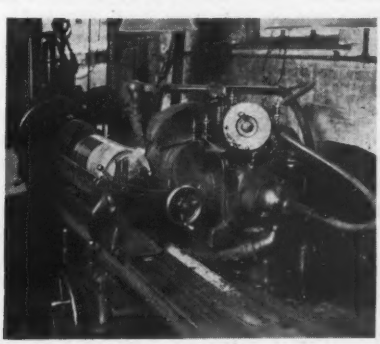


Courtesy of Cleveland Steel Products Corporation, Cleveland, Ohio

OPERATION: TURNING, DRILLING, FACING AND REAMING 3⅛ IN. FLANGE FOR UNIVERSAL JOINTS.
MACHINE: CLEVELAND 8 INCH CHUCKING MACHINE.
MATERIAL: S. A. E. 1035 STEEL.
SPINDLE SPEED: 106 R. P. M.
PRODUCTION: 25 PIECES PER HOUR.
LUBRICANT: 1 PART SUNOCO TO 12 PARTS WATER.



Courtesy of Carborundum Company, Niagara Falls, N Y

OPERATION: GRINDING STEEL ROLL, 9 IN DIAMETER, 18 IN. LONG.
MACHINE: LANDIS ROLL GRINDER, 12 IN X 72 IN.
SCLEROSCOPE: 94 TO 101.
WHEEL ROUGHING: 36-9-C9R.
FINISHING: 120-6-C8Y
POLISHING: 400-10-C10Y.
18 IN. X 1½ IN. X 8 IN
METAL REMOVED: ROUGHING .0015 IN. PER PASS. FINISHING .0005 IN. PER PASS. TOTAL AMOUNT OF METAL REMOVED, .005 IN.
WHEEL SPEED: 1700 R. P. M.
WORK SPEED: 40 R. P. M.
LUBRICANT: 1 PART SUNOCO TO 30 PARTS WATER.

SUN OIL COMPANY, Ltd., Montreal, Canada.

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Characteristics of Alloy Steels

(*Continued from page* 18)

costs, particularly as certain difficulties are sometimes encountered in heat treating.

Molybdenum, as might be expected, is sometimes added as a substitute for part of the vanadium or tungsten. The use of uranium as an alloying element has been tried, but it has not been proved to be particularly beneficial. It is important that the phosphorus and sulphur content be kept below .025 per cent for each, as, if they are higher, undesirable segregations or inclusions might occur. Manganese and silicon, while present in amounts of from .2 per cent to .35 per cent, are of no great importance if held within these limits.

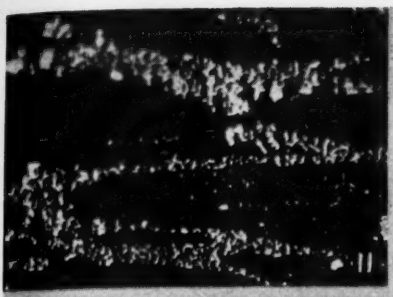
High speed steel, as cast, has a coarse, very cellular or envelope structure, in which carbide-tungstide segregations are present. These structures must be eliminated or the steel will crack in heat treating or in service. They cannot, however, be destroyed or dissolved by annealing, at least not at a reasonable cost. Therefore, the structures must be broken up by hot working, usually as a forging operation. This hot work must be thorough; more work must be done, perhaps, than is actually necessary to shape the section.

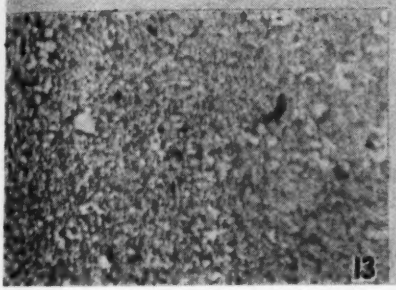
When the hot work is incomplete, a structure will be produced, on hardening and tempering, such as is shown in Fig. 11 or 12. But if the hot work is correctly done, the structure should appear with the carbides in spheroids such as that shown in Fig. 13 and 14. The steel manufacturer may market partly-worked high speed steel with the expectation that the purchaser will obtain the desired section by further forging, thus completing the necessary hot work. But the purchaser may plan to form the tools by machine operations rather than by forging, and hence should purchase high speed steel that is ready for such procedure, even though the cost may be higher, as trouble in heat treating or in service is likely to result from the use of incompletely-worked stock.

It is advisable to anneal high speed steel before forging, no matter what its degree of reduction may be. The heating for forging should be slow and cautious, and a preliminary heating at 1500 to 1600 deg. F. is desirable before heating to the forging temperature of 1800 to 2000 deg. F. The hot work should not be continued below 1600 deg. F. The annealing range to soften and to produce grain refinement is between 1570 and 1750 deg. F., and cooling should be slow to about 1300 deg. F. High speed steel is a relatively poor conductor of heat, and should be handled accordingly.

The annealing range of temperature and forging range are below the hardening temperature. A very high hardening temperature is desirable, since a more complete solution of the carbides wil be obtained and hence a better structure on cooling, but this advantage is offset by the danger of actual burning and also because the grain growth will be rapid. Hence a compromise is effected by heating to a high temperature, but cutting the time it is held there as short as possible. Preheating for hardening decreases the liability to cracking and shortens the time of exposure at the highest temperatures. The preheating operation may be divided into two stages; viz., at 1100 to 1200 deg. F. and 1500 to 1600 deg. F., and the final heating carried on at 2300 deg. Fahrenheit.

Although quenching in oil is common practice, high speed steel will harden in air or in a lead bath. Tempering should follow the quench as soon as the steel has cooled to about 200 deg. F. and the draw should be





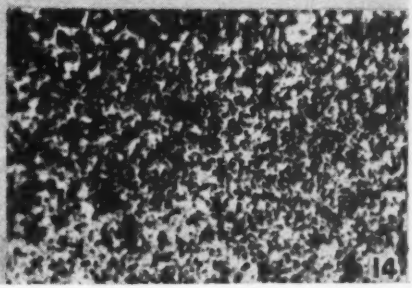


Fig. 11—Photomicrograph showing "hook" structure in an incompletely-worked high speed steel. Magnification 300 diameters. Nital etch. Fig. 12—Photomicrograph showing laminated, or banded, carbides in an incompletely-worked hot high speed steel. Magnification 180 diameters. Nital etch. Less objectionable structure than that shown in Fig. 11. Fig. 13—Photomicrograph showing structure of annealed high speed steel, free from objectionable structures. Magnification, 400 diameters. Nital etch. Fig. 14—Photomicrograph showing structure of hardened and tempered high speed steel. Note even dispersion of carbides. Magnification, 100 diameters. Nital etch.

carried out in a salt bath or other convenient manner. The drawing temperatures vary from 500 to 1200 deg. F., but 1100 deg. to 1150 deg. F. is most generally used.

The Hardness of High Speed Steel

Hardness, as applied to high speed steel, is of several different kinds. The alloying elements themselves tend to produce hardness. When quenched from moderately high temperatures, say 1740 deg. F., the steel will harden, and "red hardness" is acquired by quenching from very high temperatures. "Secondary" hardness is obtained when a steel that has been quenched for "red hardness" is properly tempered. This hardness is due to the formation of the hard constituent, matrensite, in larger amounts than occurred on the quench from the very high temperature. The steel must be tempered to release strains, and while performing this necessary draw, the temperature may as well be raised to the point where the secondary hardness will develop.

(The third article of this series, dealing with soft spots, brittleness, distortion, warping, and cracking, will be published in the February issue.)

When writing to advertisers, mention MODERN MACHINE SHOP. The more this magazine grows, the better editorial material we will be able to give you.

The Growth of Industry Continues

By J. E. BULLARD

A GREAT deal of hulabaloo has been raised, during the past year and a half, that modern machinery has been largely responsible for the business depression under which the country has been struggling. This idea has become so fixed that in some cases public work, such as, for example, road work, has been done by hand when it could have been done quicker, better, and cheaper with machinery. The idea is entirely erroneous and the error should be rectified without delay.

It is an admitted fact that the application of a labor-saving piece of equipment to a single task may reduce the number of workers necessary to carry on that particular task, but past history will prove, clearly enough, that the use of that same piece of equipment provides an entirely new set-up of conditions, in which the opportunity for employment is greater than before.

Conditions at the moment are abnormal, but a comparison of the comparatively normal conditions that existed prior to 1930 with conditions of half a century or more ago will show that the average man works shorter hours, has greater buying power, and lives better than ever before. In addition to which the disagreeable and laborious features of practically all forms of labor are being removed by the aid of those same modern devices. An average family whose members have been out of work the greater part of the past two years is still better off than was the average family 100 years ago, in the very best of times.

The fact seems to have been overlooked that there were depressions long before the era of machinery, and that the suffering during these depressions was far greater than anything that has taken place in late years. It has also been overlooked that the development of new machinery has also fostered the development of new industries, with additional opportunities for employment.

The low production costs that are made possible by labor-saving machines are responsible for the low selling costs which make every-day conveniences out of what would otherwise be luxuries, and make it possible to market hundreds of machine-made commodities where but few could be sold if they had to be made by hand. Quantity sales demand quantity production, with corresponding quantity employment of labor.

Probably the best-organized industry in the world, from a standpoint of high speed production equipment, is the automobile industry. Up to twenty-five years ago the building of automobiles was just another new industry. Then the automobile manufacturers began rearranging their plant equipment and started developing special machines, tools and fixtures for high-speed production, and immediately their industry became a factor of first importance in the economic situation. During these twenty-five years the automobile industry has been responsible for the doubling and tripling of wages, as compared to the wages that were paid previously; it has been responsible for the shortening of work-hours from ten to nine,

To quiet helical gear operation you need accurate cutting tools under positive control, such as is provided by improved Fellows Helical Cutters used on Fellows Gear Shapers.

THE FELLOWS IMPROVED HELICAL CUTTER

Achieves Immediate Success

ONE motor car manufacturer, whose salesmen are selling "the sweetest silent transmission on the road," has a gear "shop" superintendent who has something else to crow about.

Quiet gears? Sure! But what means more to him is turning out 95 per cent OK'ed assemblies. That's where the improved cutters are showing their far-reaching superiority.

The success of these improved Fellows Cutters is made practical by the ability of Fellows cutter grinding equipment to duplicate the infinite refinements of tooth profile under positive control. Let us help you quiet your gear assemblies. Write: THE FELLOWS GEAR SHAPER COMPANY, Springfield, Vermont, or 616 Fisher Building, Detroit, Michigan.

FELLOWS
GEAR SHAPERS

eight, and in one case six, and it has provided more employment than any other single industry. Without the advantage of labor-saving machinery, the automobile would cost several times as much as it costs today, placing it in the luxury class, with limited sales, low production, and correspondingly low employment of labor.

The statement made above regarding the automobile industry also applies to other industries. Were it necessary to make each piece by hand, or even to machine it individually, the cost of a vacuum cleaner or an electric refrigerating unit would probably be three times what it is today, and the huge plants that are required in order to fill the normal demand for such commodities would occupy but a small fraction of the space they now fill, with correspondingly small labor requirements. Only when a person is privileged to pass through one of these plants and see the manner in which everything possible is done to keep manufacturing costs to the minimum does he realize fully that, as production costs decrease, employment increases.

Today there are many plants about the country that are in process of "growing up." The large industries are pointing the way to low production costs, with resultant lower selling prices, increased demand and production, and corresponding increases in employment. Everywhere are plants that have doubled or tripled their facilities in the last half dozen years, for which the adoption of modern methods can be credited. The prices of many commodities are being lowered, not to meet a price demand, but on account of lowered manufacturing costs due to the use of modern equipment. It is admitted that in some cases the prices have been maintained at a high level long past the time when they should have been reduced, but without the advantages of modern equipment no reduction would be possible. Production would be slow, manufacturing costs would be high, wages would be low, selling prices would be high, the demand would be small on account of the prices, and employment would be small due to restricted demand.

Excepting for the present slack condition—which is generally admitted to be now purely a matter of psychology—American industry is on a better footing than it has ever been, and will be in even better shape in the future. The small shop of yesterday is the small manufacturing plant of today and will be the big production plant of tomorrow. As it progresses from one status to the next, its place will be taken by others who, if they are progressive, will follow the same route.

Whereas our progenitors accepted disagreeable, back-breaking labor as a necessary part of life, those of this generation have learned that mechanical equipment can be developed, within reasonable limits as to cost, to eliminate the grief from practically any sort of task, industrial or domestic, and thus a demand is created for many types of products that were unheard-of in the last century. The natural consequence is an opportunity for the creation of new industries with additional opportunities for labor, which has brought the percentage of industrial workers as compared to the total population to a higher point than it has ever been before. Without modern methods of manufacture, the costs of such mechanical aids—large and small—would be as high as the cost of hand labor, and hand labor would be used as a natural sequence. Thus again would markets and a demand for labor have remained undeveloped.

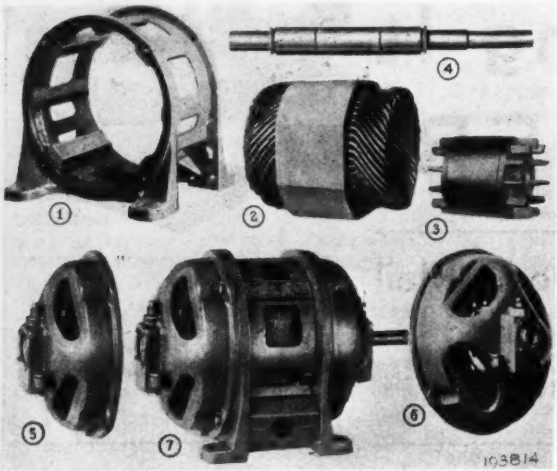
The machine will end the present depression, and the growth of industry will continue.

Interchangeable-Unit Motor Saves Time for Industry

Stock of repair motors no longer necessary—defective parts can be replaced quickly and economically.

By DONALD A. CLARK

THE modern electric motor, as produced by leading American motor manufacturers, is so designed that failure in service is rare and unusual. It is not impossible, however, and when failure *does* occur, it usually means that a department, machine section, or machine will be out of service until the motor can be repaired, or, at best, replaced.



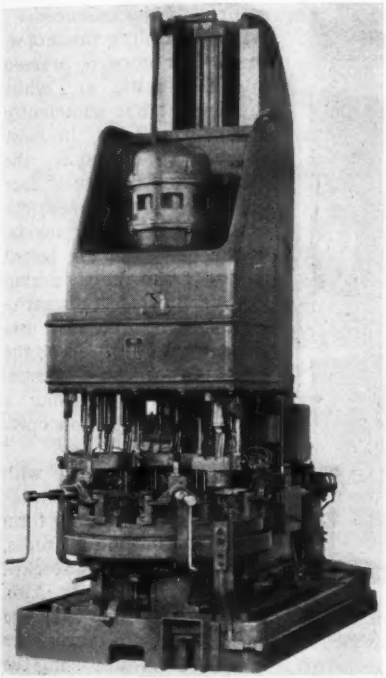
Westinghouse Interchangeable-Unit Motor. (1) Cast horizontal-type frame. (2) Stator core, machined to a press fit in the frame. (3) Rotor. The rotor bars, end rings, and blower vanes are cast of pure aluminum under hydraulic pressure. (4) Rotor shaft. (5) and (6) Cast brackets. (7) Assembled motor.

In the larger plants where the motor must be replaced immediately so that production can be continued, a stock of motors in duplicate for each type of motor in use must be maintained. In the smaller plants, the motor must be removed to the repair department, or to the nearest motor repair shop, and production must be suspended until it is returned. If the motor is a "built-in" unit, it is probable that the machine will be out of production, even in a large plant.

The trend has been, in later years, toward the development of highly specialized units for individual production operations, and thus a demand has been created for motors with special features in order that the best possible results might be obtained from the machines. When the motor in such a unit fails, it is probable that not only will production on this particular operation be stopped, but that an entire line of operations will be blocked. Thus the loss entailed by failure of a motor may be out of all proportion to the cost and worth of the motor.

However infrequent, motor failures with their resultant losses in time and money, as well as the confusion caused

by the disturbance of production schedules, have bred a demand for motors so completely standardized that the parts can be interchanged, thus making it possible to remove a defective part from a motor and replace it with a good one in a comparatively short time, and without removing the



Westinghouse interchangeable-unit motor as applied to a Natco multiple spindle drilling machine.

motor from its anchorage. A complete line of such motors is now being built by the Westinghouse Elec. & Mfg. Co., Pittsburgh, Pa.

Instead of manufacturing the motor as a single complete unit, as has been the practice on similar motors in the past, the different parts are manufactured on a production basis as independent units, within limits which make possible the use of any unit in any motor. The outstanding feature of this type of construction is the complete separation of the electrical from the mechanical parts, which makes possible the use of practically any type of frame structure, depending upon the requirements to be met, without sacrificing the good features of any of the parts.

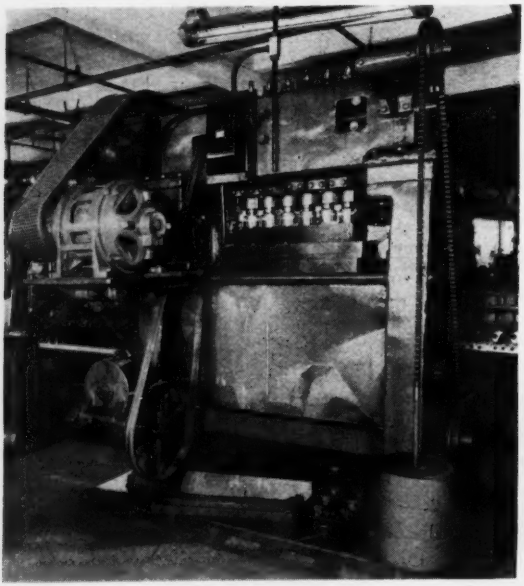
The frame is cast, which would seem to be a reversion to the older types of construction. Due to improved methods of foundry practice, however, it is now possible to produce a cast motor frame which will compare in weight very favorably with the so-called "frameless" construction that has been used in late years. With the frame as a separate part, the customer can be supplied with any one of a number of different types of frames. The first frame developed for this purpose was the open horizontal type, after which followed the closed horizontal type, and later the open or closed vertical frame.

The stator laminations are built into a unit core, making it independent of the frame that supports it. Eight rivet holes are machined in, adjacent to the periphery and well outside of the flux path. Heavy finger plates of special design are used, and the finger plates and punchings are stacked and riveted together to form a solid core.

The insulation used in these motors consists of fish paper and treated cloth, cemented together to form a cell slot, the fish paper for mechanical production and the treated cloth for current insulation. The combined cell has a binder stitched on each end to prevent tear, and a further seal is provided by treating the ends. A combination U-shaped center wedge separates the top and bottom coils, and a U-shaped top wedge seals the cell. The coils are made of single cotton-covered enameled wire, chain-con-

nected to minimize the number of joints.

Groups and leads are connected to adjoining groups by means of welded connections instead of conventional soldered connections, eliminating the possibility of solder dropping between the coils. All coils are completely insulated with overlapping tape. Between phase coils heavy treated cloth is used to prevent insulation breakdown between phases. The complete core is baked to remove the moisture and then receives successive bakings and dippings in two different compounds which provide protection from moisture as well as a tough, flexible finish.



An interchangeable-unit motor driving a boring machine in an automotive cylinder production line. Break-downs or delays are costly here.

Very careful consideration has been given to the design and method of construction of the rotor. The rotor laminations are assembled on skewed arbors and the rotor bars, end rings, and blower vanes are cast of pure aluminum under hydraulic pressure in one operation. This type of rotor is light and easily balanced, and is economical in the use of power on applications that require frequent stopping, starting, and reversing. Being cast under tremendous pressure, the rotor remains balanced.

In assembling the motor, the stator core is pressed into the frame, and while the press fit is sufficiently close for any but the most severe applications, the core is tack-welded at four different points as a safety feature. The brackets, which are cast, are bolted to the frame with a ring groove fit that automatically and permanently sets the air gap and aligns the bearings, making assembly after dismantling a comparatively simple operation.

As the rotor core with its winding and the stator core with its winding form complete individual units, these parts may be stocked for repair purposes. Also, it is possible to vary the electrical characteristics of a motor while using the same set of mechanical parts, or, with a given set of electrical parts, the mechanical characteristics may be changed in an almost unlimited range of combinations.

Motors can be supplied with a frame without feet, for vertical or flush mounting against the side of a machine. Either horizontal or vertical frames can be furnished, either as the standard open type or as a totally enclosed frame in which all ventilation openings are omitted, depending upon the conditions under

which the motor is to be operated. If a certain amount of protection seems necessary, the motor can be semi-enclosed by applying covers—either perforated or solid—to the flat-lipped bracket openings, with a sheet metal cover attachment over the frame. In cases of machine mounting, the electrical units may be supplied separately or any desired combination of electrical and mechanical units necessary to suit the application may be had.

The machinery builder can now build his machine around the power unit and thus make a better-looking, cheaper, and more compact machine in which the motor is incorporated in a well-balanced design, with no extra material required for mechanical purposes. The user of such a machine will find it unnecessary to keep a complete spare motor on hand as a "spare" in case the motor fails. Only the part-units most subject to damage need be carried in duplicate for repair purposes, which reduces the inventory of repair parts and the corresponding investment. When repairs *are* necessary, the unit type of motor construction makes replacement of the damaged part as easy a task as replacement of the motor would be.

The Care of Grease Cups Is Important

By R. H. KASPER

TO the casual observer, it might seem that the only care required by a grease cup is periodic filling with a good grade of lubricant. The experience of the writer has, however, indicated otherwise, although the best grade of lubricant should be used.

Grease is nothing more than oil, mixed with a fat, or "soap," as it is commonly called, to render the oil less liquid, or to give it "body." All greases tend to separate, the rapidity of the separation depending upon the quality of the fat employed and the conditions under which the grease is used. The manufacturers of greases have been unable to overcome this tendency entirely, although in the best grades of grease the tendency is less pronounced than in cheaper grades.

Grease cups in which the flow of lubricant to the bearing is regulated by the pressure of a plunger cause more rapid separation than those which are "fed" by turning by hand. Pressure cups, after being in use for some time, will be found to contain a layer of solidified fat built up around the plunger, the thickness of which depends upon the length of time the cup has been in use and the quality of the grease employed. Grease that is forced into a cup under pressure separates more rapidly than it otherwise might, as the pressure tends to promote separation. The thicker the layer of fat on the plunger, the greater will be the pressure required to force further grease into the cup, resulting in further separation. This process may be continued until the solidified matter almost fills the cup. The statement of this fact should not be construed as discrediting the use of the grease cup, however; its use is indispensable on many types of equipment. But the condition is one that should and can be overcome by simple means.

There are two rules which, if followed, will prevent bearing damage due to separation of grease in grease cups. The first rule is that grease cups should be completely emptied before they are refilled. The practice of refilling grease cups when they are only partly empty permits some of the old grease to remain indefinitely to separate and solidify. If this cannot be done with safety, or if a regular lubricating schedule must be maintained, the second rule applies—which is to remove each cup at regular intervals and clean it thoroughly. The cleaning may be done by immersing the cups in gasoline or carbon tetrachloride until the soap is dissolved.

Ideas From Readers

This department is a clearing house for ideas. If there is a "kink" or short cut in use in your shop, send in a description of it. We will pay $5 for each one published.

Repairing a Bearing in an Automatic Screw Machine

By JOHN LARSON

THE drawing, Fig. 1, shows the general design of a bearing bushing in a common type of multiple spindle automatic screw machine. Such a bearing became worn approximately 1/32 in. in each end, making it necessary to have the machine repaired. As the machine was needed badly, and as we had no duplicate bearings, I repaired the bearing as follows:

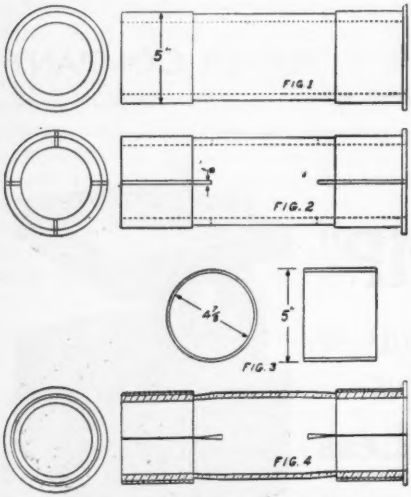


Fig. 1—Design of original screw machine bearing bushing.
Fig. 2—Bearing with four slots cut in each end.
Fig. 3—Dimensions of iron bushings.
Fig. 4—Bearing with ends closed and rebored.

I removed the bearing and cut four slots, each ⅛ in. wide and 3½ in. long, in each end of the bearing, as shown in Fig. 2. Then I made two bushings, turning, boring and cutting them off from the end of a piece of pipe, to the dimensions shown in Fig. 3, the 5-in. diameter being the same as the diameter of the bearing bushing. I bored the iron bushings to slightly more than 5 in. on one end, tapering them sharply to 4 15/16 in. and then gradually to 4⅞ in., and then pressed them onto the ends of the bearing, closing each end of the bearing enough so that it could be rebored to the original size, with plenty of stock to take out. When finished, the bearing appeared as shown in Fig. 4.

The bearing was then replaced in the machine and the machine was back in service within a few minutes. It has been running ever since. A recent examination of the bearing showed that it was giving just as good service as the others.

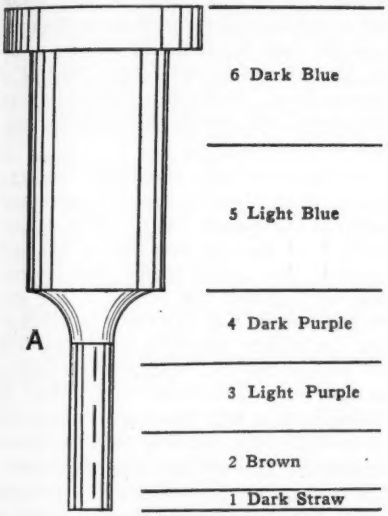
Eliminating Undue Breakage of Piercing Punches

By F. J. WILHELM

IF the following suggestions are considered in the turning and heat treating of piercing punches, a great deal of unnecessary breakage will be eliminated. Usually punches of this type are hardened in a lead bath or end-heated and drawn as one would a cold chisel. This method usually allows the punch to buckle or swell at the space on the drawing marked "3."

Also, it is not unusual to find that

punches made by different mechanics have shoulders with radii of various sizes and have necks with different kinds of tapers. If the taper is too great, making the neck too small at the point indicated as "A" on the



The part indicated by (1) should be drawn to a dark straw color; the other colors will follow.

drawing, the chance for cracking at this point is great. Also, it frequently happens that a sharp-cornered shoulder is left at this point, either caused by failing to start the radius flush with the turned surface of the punch or by undercutting with a sharp-cornered radius tool. Such a shoulder will invariably lead to cracking in the hardening operation. Even file marks left at this point may cause the punch to crack in hardening.

The punch should be finished entirely with the lathe or grinder; no file should be used, particularly at point "A." If the punch is finished by grinding, a light radius should be dressed on the wheel so as to avoid the possibility of forming a sharp corner. If no grinder is available, a tool bit ground to form a complete radius on the end can be used satisfactorily. A radius considerably larger than the actual cross section of the tool-bit can be ground on the end of the bit by holding it at an angle while grinding. It should be set at the same angle in the toolholder.

The writer has found that a punch of this type can be heat treated satisfactorily by hardening it and then setting it, shoulder end down, on a piece of hot steel. It should be allowed to stay there just long enough to allow the color to run to a dark straw in the last eighth-inch nearest the end, indicated as space No. 1. While this is taking place, the space numbered 2 will turn brown, 3 will be light purple, 4 will be dark purple, 5 will be light blue, and 6 will be dark blue. The maximum of toughness is produced at the part numbered as 3, where it is needed; a little less is produced at 4, and just enough at 5 to keep the punch from bending when pressing it into the punch pad. When punches must be extra long, they should be protected by hardened and ground or lapped bushings in the stripper.

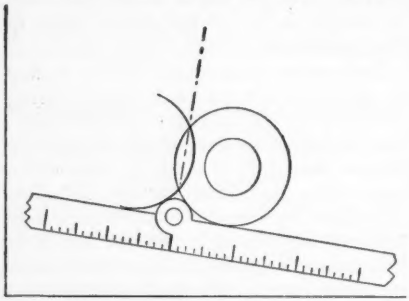
Drawing Perpendiculars With a Two-Foot Rule

By MORRIS A. HALL

SOMETIMES while in the shop or yards, the foreman or draftsman finds it necessary to make a fairly accurate drawing in which a perpendicular is drawn tangent to a base line, and finds that nothing can be used as a square or triangle. If he is in the habit of carrying a two-foot folding rule, of the type that is made with a brass hinge at the center, or one-foot mark, the rule can be pressed into service as follows:

Open the rule and lay it along the line to which the perpendicular is to

be erected. Then lay a washer, coin, or other small round piece on the paper, fitting it snugly into the corner formed by the hinge, and draw an arc around it. Then move it to the other side of the hinge and draw another arc. The two circles will intersect at two points; thus a line drawn through the two points of intersection will be perpendicular to the base line.



Drawing showing method of drawing a perpendicular by using a two-foot rule.

Amplifier Rod

By CHARLES R. WHITEHOUSE

THE drawing shows the design of a small tool that has a multitude of uses in the modern plant and will serve in many cases as well as high-priced instruments, yet is simple and inexpensive to make.

Amplifier rod of simple design.

The tool is an amplifier rod, and is valuable for transmitting and amplifying delicate sounds and vibrations. It is made of ¼-in. diameter drill rod of a length that is governed by the individual requirements, and with a handle of hard wood that is driven onto the end of the tool as a file handle is driven on. The handle, however, is made of mahogany, and is of an even diameter for the entire length. The end of the handle is recessed to a depth of approximately ½ in., as shown in the illustration. The end of the rod is sawed through the center for a distance of an inch from the end, and the two sections are spread so as to form a prong not unlike that of a tuning fork. The rod is heated so that the prong can be spread without danger of breaking.

If there is any suspicion that the rotor of an electric motor is scraping against the stator, the question can be settled by resting the end of the rod against the motor frame and placing the ear against the recess in the end of the handle. If the rotor is contacting the stator, the scraping noise will be picked up and transmitted plainly to the ear. Likewise "drag" can be detected in a ball bearing, or the grind of a shaft in a bearing that needs refinishing. In very fine grinding, where the contact of the wheel with the work must be so light that sparks will not show readily, the prong of the rod can be placed against the tailstock of the machine and the instant the wheel touches the work, the vibration will be transmitted to the ear.

The tool will be found invaluable by the toolmaker, millwright, or repair man, and uses will be found for it that could not possibly be enumerated here.

Edward G. Budd Manufacturing Company purchased more castings and tool steels in August and September than in any corresponding months since 1928.

Chrysler Corporation's sales in the first eleven months of 1931 were 10.7 per cent higher than in the same period of the previous year.

Over the Editor's Desk

THE most important news of the moment is the news that our industries are getting up steam, one after another, and swinging back into production. There are still many, however, who insist upon seeing smoke from their neighbors' chimneys before they will fire up their own boilers, so we submit the following for their benefit:

The Union Pacific Railroad has recalled 3,000 men to work in its Los Angeles shops.

The Reading Railroad is spending $4,000,000 in extending its electric passenger service to Norristown, Pennsylvania, thus furnishing employment to several thousand men.

Orders scheduled by the Globe-Wernicke Company of Cincinnati insure full-time operation of its plant for five months ahead.

The forty-four mills of the McKeesport Tin Plate Company are now working on full time.

The Allis Chalmers Company has received an order from the Pennsylvania Railroad for $1,000,000 worth of equipment, to be built in the Milwaukee shops.

The John Deere Tractor Company has recalled 1,000 employes to its Waterloo, Iowa, plant.

$18,860,000 worth of building and construction work will be done in Fort Worth, Texas, in 1932.

General Motors Corporation's sales of automobiles in November showed a gain of 13.1 per cent over October.

The New York Subway System has placed a contract for $2,317,800 worth of equipment with the General Railway Signal Company.

The Cadillac Motor Car Company is now operating on a normal payroll of approximately 6,000 employes, and this force is expected to be maintained throughout the season.

Orders totaling in excess of $11,000,000 have been placed by the Auburn Automobile Company for materials to be used in estimated production during the first three months of 1932.

Willys-Overland is now operating with a force of 7,000 men, and has started production of 500 cars daily. Operations have been held up due to inability to obtain delivery of materials from part-workers.

The Chevrolet Motor Company's gray iron foundry at Saginaw, Michigan, has resumed operations with 3,200 workmen.

Missouri Pacific Lines has recalled 950 workers to its shops at North Little Rock, Arkansas.

Westinghouse Electric & Mfg. Corp. has recalled several hundred men to its Sharon, Pa., plant on a $1,400,000 contract for car transformers.

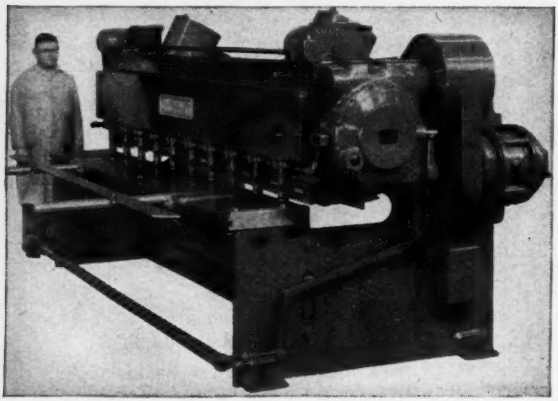
The Bessemer & Lake Erie Railroad has increased the working schedule at its Greenville, Pa., shops from 33⅓ per cent to 66⅔ per cent. The new schedule affects 1,000 men and all employees who were laid off May 14th will be called back, at least on part time.

Contracts for 100,000 tons of steel sheets and strip steel are understood to have been placed by a large automobile manufacturing company, probably the Ford Motor Company, with the National Steel Corporation or subsidiary companies. This is the largest order of its kind of the year. The sheets will be rolled by the Michigan Steel Corporation and the National Steel Corporation.

New Shop Equipment

Cincinnati All-Steel Shear With Hydraulic Hold-Downs

An all-steel squaring and slitting shear with hydraulic hold-downs, designed for unusually high speeds and an exceptional degree of accuracy, is announced by The Cincinnati Shaper Co., Elam and Garrard Streets, Cincinnati, Ohio.

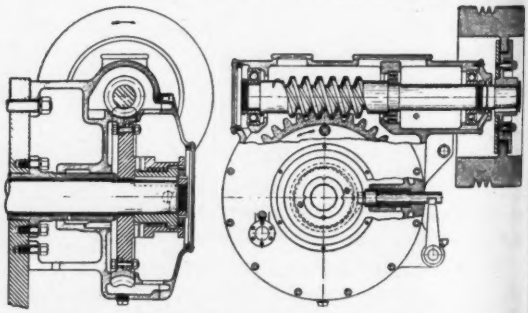


Cincinnati All-Steel Shear with Hydraulic Hold-Downs

A speed of 60 strokes per minute is obtained with the $\frac{5}{16}$-in. shears of 10 and 12-ft. lengths, and the $\frac{1}{2}$-in. shears of 10 and 12-ft. lengths operate at 40 strokes per minute. The accuracy is due to several factors, the most important of which are the hydraulic hold-downs, the low rack, and the rigidity of the all-steel construction. The pressure of each hold-down is not only great, but is uniform at each hold-down regardless of variations in the thickness of the sheets, thus eliminating slippage. The low rack or shear angle—$\frac{1}{16}$ in. per ft. on the $\frac{3}{8}$-in., 12-ft. shear—greatly reduces possibility of distortion in the work.

The main members are made of rolled steel plate, which provides the necessary strength for accuracy and the rigidity for long knife life. These members comprise the housings, upper and lower knife bars, bed, pitman links, and back brace. The manufacturer guarantees the frame against breakage for a period of five years.

The low, compact design results from the position of the drive shaft, which extends behind the upper knife bar instead of above it. By means of eccentrics, this shaft pulls downward and slightly backward on the knife bar by means of steel pitman links, holding the bar securely against the hardened flat guide bearings. The spring counterbalances not only hold the knife bar against the housing bearing, but also act as a brake on the shear. The multiple, low-tension springs are designed with a counterbalancing action



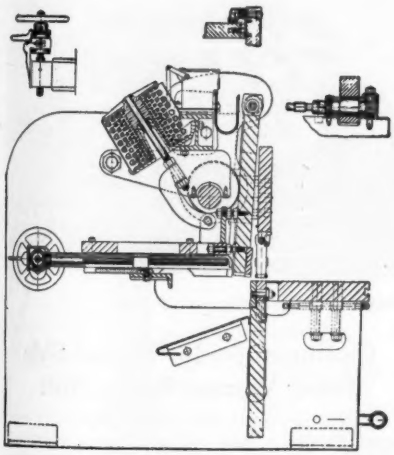
Drawing showing drive from flywheel through worm and wheel to main shaft. If overloaded, the flywheel rim slips on its mounting and prevents breakage.

such that they hold the upper knife bar at the top of the stroke when the clutch is disengaged.

A deep steel plate is used for the upper knife bar, and a hardened and ground guide bearing for the knife bar is mounted on the housings. The knife bar slides, bronze-lined, bear around this guide. A deep horizontal steel brace, fastened to the back of the upper knife bar, prevents the knives from springing apart. Adjustment is provided between this brace and the bar at 12-in. intervals, thus maintaining exact alignment of the knives.

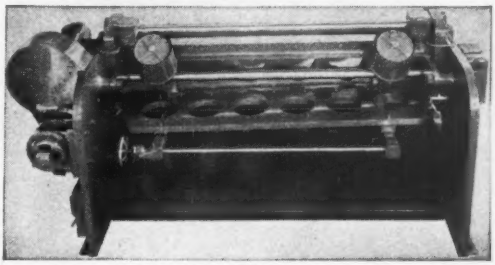
A vertical adjustment to the upper knife bar, controlled at one point, has been provided for use when slitting. When this vertical adjustment is in the "up" position, the knives will not pass at the open end and the shear can be used for slitting. When the adjustment is in the "down" position, the knives come together for their entire length.

The drive is by V-belt from motor to



Cross-section of the complete shear, showing the table in-and-out adjustment to obtain proper knife clearance.

fly-wheel, then through a silent worm and wheel reduction unit to the main shaft. Friction discs in the fly-wheel, adjustable for varying loads, prevent damage to the shear from overload. The worm is hardened and ground and mounted on anti-friction bearings. The worm-wheel has a rim of high tensile strength bronze, mounted on a steel disc in which five clutch jaws are cut. The



Rear view, showing adjustable back brace for the knife bar and back gauges with direct-reading dials.

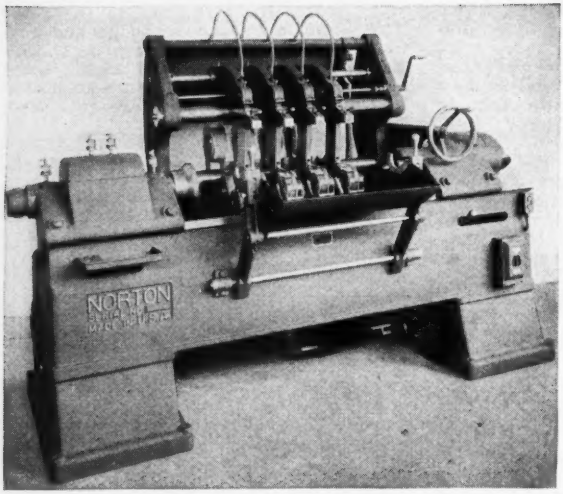
clutch is slidably mounted on a hardened splined sleeve which is keyed on the tapered end of the drive shaft. When the clutch pin is withdrawn, by depressing the treadle, the solid jaws are forced into mesh by a heavy spring.

The bed rests directly on the solid housing plates and is adjustable backward or forward to obtain proper knife clearance. Recesses make the lower knife bolts accessible from above. The recesses are covered with a steel plate machined flush with the bed. Finger slots enable the operator to grasp the sheet.

The shears are made in standard sizes for shearing 10-ga., $\frac{1}{8}$, $\frac{1}{4}$, $\frac{3}{8}$ and 1/3-in. plates. Standard lengths are 6, 8, 10, and 12 ft. Lengths of 14 and 16 ft. are also available. The ratings are for continuous or mill duty at maximum rated capacity. Standard equipment on all sizes includes one-piece, four-edge knives; front, side, and universal ball bearing back gauges, and V-belt motor drive to the fly-wheel.

Norton "Type 40" Lapping Machine

A crankshaft lapping machine for lapping simultaneously the pins and bearings of automotive crankshafts has been developed by Norton Company, Worcester, Mass. The shaft to be lapped is rotated between a live headstock and a floating footstock center, and the lapping arms, one of which is required for each pin and bearing, are equipped with



Norton "Type 40" Lapping Machine Using Abrasive Paper.

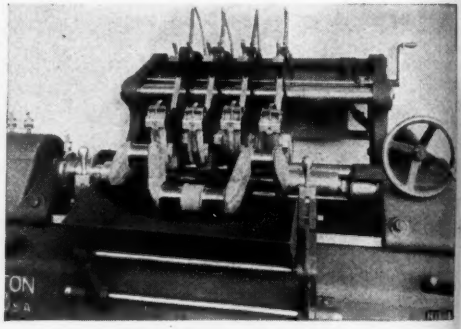
A feature of the machine is the supporting housing for the lapping arms. Upon completing the lapping of a shaft, each arm is released and the housing is swung backward by a spin of the handwheel. Thus the lapping arms and their supporting members are moved out of the way for loading and unloading.

The machine will swing 16 in. diameter over the table and will accommodate a maximum length of 48 in. Crankshaft pins and bearings up to 2½ in. diameter by 4½ in. long can be lapped. The machine weighs, complete, 4,800 pounds, and requires floor space approximately 56x104 in. It is available in either motor driven or belt driven type.

telescoping reels, each of which carries a roll of abrasive paper. Each time a lapping arm is removed from a pin or bearing, the rolls index automatically, thus presenting a fresh, unused abrasive surface to each pin and bearing lapped.

By means of a reciprocation mechanism in the headstock, the shaft is caused to move back and forth in the direction of its axis. This action improves the finish and eliminates all grinding wheel marks. Lapping lubricant is pumped to each arm by a pump which, with its driving motor, is a complete unit supplied as a part of the machine equipment. The motor is wired for 110 volts, A. C., and can be connected to a light circuit. Motors of other voltages are available.

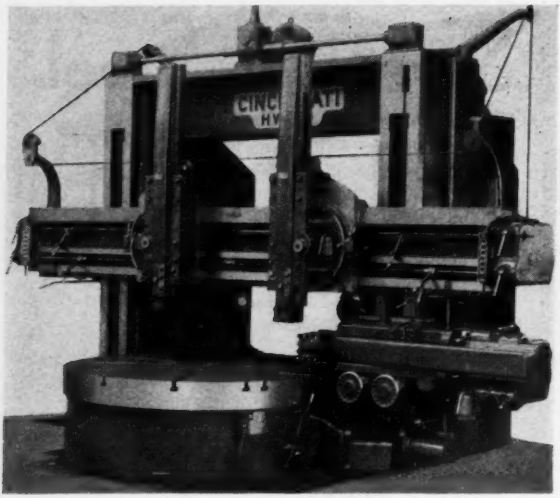
The bed of the machine is a heavy, rigid box section, upon which the headstock is mounted permanently at one end and the footstock is mounted adjustably at the other end to accommodate a range of crankshaft lengths. The footstock center is operated by a treadle, thus permitting an operator to use both hands when loading. A work-loading fixture to be attached to the front of the bed can be provided as additional equipment. The fixture is convenient when lapping heavy shafts.



View of Lapping Arms in Action.

Cincinnati 96-In. Hypro Side Head Vertical Boring Mill

The Cincinnati Planer Company, Cincinnati, Ohio, has brought out a vertical boring mill—the 96-In. Hypro—in which the bed and extensions are cast as a solid unit instead of in two separate castings, as is usually the case. Thus the loose extensions are eliminated and stiffer support is provided for the housings. The housings are both bolted and doweled to the side of the bed and are tongued to the bed, the tongues being



Cincinnati 96-In. Hypro Side Head Vertical Boring Mill.

cast integral with the bed. The bed is so designed that the housings are bolted to the center of the bed by extending the front of the housings.

The heavy, deep table is driven by a steel spiral gear and pinion. The thrust of the pinion is taken by an anti-friction bearing, insuring a smooth drive. The speed box is provided with four changes of speed when using a variable-speed D. C. motor, and in cases where the only current available is A. C., a triple box is placed on top of the speed box, providing twelve changes to the table speed.

Forced lubrication is supplied to the spindle bearings, track, and gear box. A tank is located directly under the spindle, and an individual motor-drive pump, mounted on the housing, forces oil into the track and all other moving parts. A filter is placed in the oil-line to insure clean oil, and a pressure gauge is placed so that the operator can see whether his pump is operating. The track is a separate unit so that in case of damage this unit can be replaced.

The rail heads are equipped with steel rams and are lubricated from a central station. The ways of the rail are lubricated so that the head slides along the rail on a film of oil. The head can be swivelled to 45 deg. each side of center by means of a worm and segment. A clamp is placed on top of the saddle to assist in holding the swivel rigid to the saddle. Fine adjusting levers are supplied so that the heads can be set at any position along the rail by moving these levers. These levers can be placed convenient for the operator. The rail is exceptionally heavy and rigid. An electric or mechanical rail clamp can be supplied. In both designs the rail clamp interlocks with the elevating motor so that it is impossible to raise or lower the rail while clamped.

A feed box with twelve changes is placed on each end of the rail and on the side head. All of the gears are of chrome nickel steel, hardened. All of the bearings are anti-friction. The alloy gears slide on hardened splined shafts. Gravity lubrication is used to lubricate all of these bearings. The reverse of the feed is also placed inside of this box. An individual rapid traverse motor, for rapid traversing the heads in

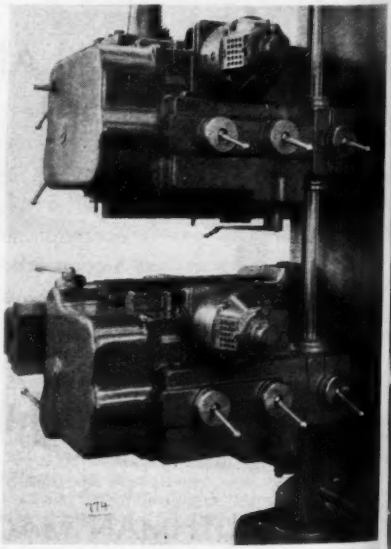
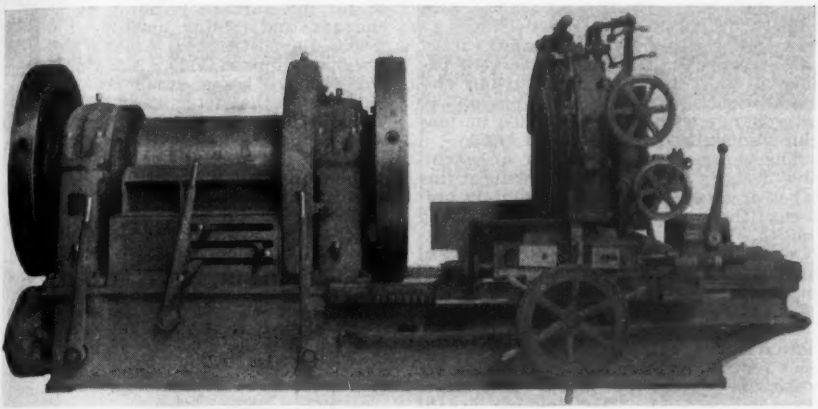


Illustration showing how the saddle is placed on the housing.



Landis 13⅜-In. Pipe Threading and Cutting Machine.

all directions, is connected into the feed box. Individual motors for each head enable the operator to move either head in any direction without disturbing the other.

The side head is of an entirely new design. Alyl tool pressure is absorbed by the heavy wall on the housing, located about 24 in. from the face. The ram can be placed in any position and the resultant tool pressure is always within the housing bearing. Taper gibs are used throughout to take up wear and maintain perfect alignment. The saddle is cast with the ram clamp in place, which eliminates a large number of bolts. Taper gibs provide the necessary adjustment. For feeding and rapid traversing the side head the same feed box unit is placed on the back of side head saddle. Hand wheels are provided for final adjustment to saddle and ram.

The Landis 13⅜" Pipe Threading and Cutting Machine With Receding Chaser Die Head and Leadscrew

The Landis Machine Company, Inc., Waynesboro, Penna., has added another pipe threading and cutting machine with receding chaser die head and leadscrew to its well-known line of pipe machines. This machine, known as the 13⅜ in. size, has a capacity of 4½ in. to 13⅜ in. It will generate a tapered pipe thread of any length up to and including 8 in. and any tapers of ¾ in. per foot and less on all pipe, casing and tubing sizes within its range.

The receding chaser feature reduces the cutting strain on the chasers to that required for a straight thread of like diameter and pitch, and insures super-accuracy and an exceptional finish. It also permits the use of a very narrow chaser, which lowers the initial chaser cost approximately 50 per cent, adds materially to the life of the chasers between grindings, and otherwise effects a saving.

The die head has a universal adjustment for size. In addition there is a micrometer adjustment for the final setting. Each graduation on the micrometer dial gives a variation of .001 in. in diameter. The die head is a "two-cut" head and can be used for roughing and finishing, the roughing and finishing cuts being controlled by the same receding mechanism. The finishing cut can be made without any change in the diametrical adjustment.

The chaser holders of the die head cover a range from 8⅛ in. to 13⅜ in., but chaser holder extensions having a range from 4½ in. to 8⅝ in., can be fitted to the chaser holders so as to give the die head a total range of 4½ in. to 13⅜ in. inclusive. The chaser holders are adjustable to and from the center to insure an equal distribution of the cut.

A chaser 1⅛ in. width is employed for all thread lengths. The chaser holder chasers have an initial length of 4 in., but they may be used in the chaser holder extensions after they have been ground to a 3 in. length or less. The same chasers can be used for any pipe

size within the ranges of the chaser holders or chaser holder extensions, as long as the pitch, taper and thread form are constant. The chasers of the 13⅜ in. pipe threading and cutting machine with receding chaser die head will interchange with those of the 8⅝ in. machine announced in September, 1930.

The taper mechanism is of an exclusive design. It generates a straight line taper or a taper which is absolutely uniform throughout the entire thread length. The sine bar is easily and quickly adjusted for all tapers. A tapered plug provides a positive means for locating the sine bar for the ½ in., ⅝ in. and ¾ in. tapers.

The sine bar retarding bracket, which actuates the taper mechanism, is adjustable for the length of pipe extending beyond the face of the chuck. It is set to have contact with the sine bar at the start of the thread.

The leadscrew is located centrally between the guides of the machine and takes the load without binding the carriage. It has a coarse pitch thread with a round crest to facilitate the engagement of the nut.

The leadscrew nut is of the split (full-nut) type and is made of bronze. The two segments are mounted in a steel carrier. The leadscrew nut is engaged by hand, and may be disengaged either automatically or by hand.

The pitch change gears are housed in a gear box at the headstock end of the machine. The intermediate gears are mounted on a floating carrier of a new and original design which greatly simplifies the meshing operation. A single nut clamps the intermediate gears and their carrier in place.

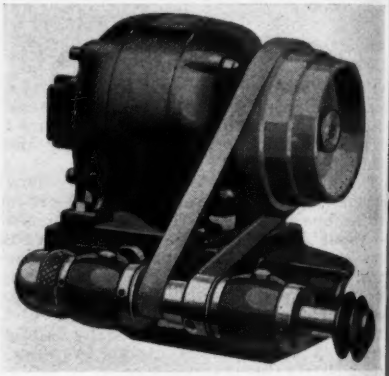
The cutting coolant is supplied to the chasers through ducts in the bore of the die head, located so that the cutting edge of each chaser is flooded with coolant. This machine is highly efficient for ordinary pipe and standard pipe threads, still more efficient for seamless and alloy steel tubing and yet more efficient for long thread lengths.

Improvements in "Layth-Grindar"

A number of refinements have been made in the design and construction of the "Layth-Grindar"—a precision grinder, made by Layth-Grindar Corporation, 30 Canfield Street, Orange, N. J., for use in performing external, internal, or face grinding in connection with engine lathes of either floor or bench type, or for flat surface grinding on planers, shapers, and milling machines.

The Layth-Grindar uses a standard low-speed motor (1725 r.p.m.) on all the engine lathe sizes except the ⅛ h. p. unit, where the motor speed is 3450 r.p.m. These speeds are "stepped up" to the desired spindle speed, so that the highest speed in the machine is in the spindle, and not in the motor, thus avoiding excessive vibration and resultant wear.

The motor base and spindle bearing brackets are cast in one piece, eliminating joints. The forward (right-hand) spindle bearing is a long, pre-glazed cast iron sleeve, ground to a taper and lapped to perfect contact with the spindle. The rear (left-hand) bearing is a tapered, four-slotted phosphor bronze sleeve



Improved Layth-Grindar

ground to a perfect spindle fit, with an accurate compression adjustment for wear. A ball thrust bearing holds the spindle to a perfect seat in the taper sleeves. Steel lock nuts maintain the adjustments and make it possible to remove the spindle without disturbing the bearings.

The spindle pulley is mounted between the spindle bearings, equalizing the load on the bearings and avoiding any tendency to spring the spindle or to set up vibration. Belt center adjustment is obtained by moving the motor base plate forward or back in machined V-grooves by means of a screw. It is locked in position by means of a setscrew.

The Layth-Grindar is mounted on the lathe compound, where a broad, firm contact can be obtained between two large, flat, machined surfaces, locked together by a sturdy T-slot bolt. With each Layth-

Grindar three ground steel shims are provided, in three different thicknesses, each of the same size as the grinder base, making it possible to obtain vertical adjustment without loss of rigidity.

An ample oil reservoir space is provided in each bearing, with spiral and connecting grooves in the sleeves to assure proper oil distribution, and with felt end washers to prevent oil leakage.

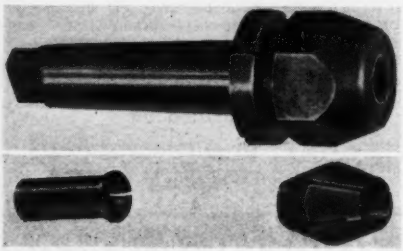
In the smallest two Layth-Grindar sizes (bench lathe types), two-step cone pulleys have been found to provide all the speed range necessary. On the engine lathe sizes (except on the 1 h. p. unit), three-step cone pulleys are provided, which, by reversing the spindle pulley, will give five different spindle speeds. It is not necessary to change belt and pulleys with each change of wheel diameter.

Each Layth-Grindar is shipped in a substantial container with handles, hinges, and latches, holding, in addition to the grinder, an adequate equipment of extension arbors, spanner wrenches, open-end wrenches, T-slot bolt and nut, shims, extra belt, diamond holder, safety wheel guard, rubber-covered wire, switch and wheels.

"Progressive" Spring Collet Chuck

Users of straight shank end mills, drills, reamers, keyway cutters, and similar tools will be interested in a new design of spring collet chuck that has been placed on the market by the Progressive Tool Co., 419 Hendrie Street, Detroit, Michigan.

The chuck is a complete unit, with 1-in. master collet and reducing bushings for ¾, ⅝, and ½ in. The shanks, master bushings, and reducing bushings

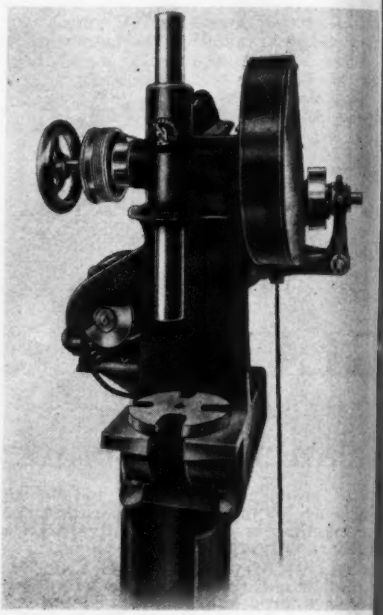


"Progressive" Spring Collet Chuck

are made of Hecla chrome vanadium steel, properly heat treated and ground. Correct alignment of the nut with the shank is provided for by ground bearings on both nut and shank. Cutting tools may be changed rapidly by giving the hexagon nut a half turn. The chuck is made in sizes to fit all standard spindles.

No. 50 Greenerd Arbor Press

The Greenerd Arbor Press Company, Nashua, N. H., announces a motor-driven arbor press of three tons capac-



No. 50 Greenerd Motor-Driven Arbor Pres

ity, to be known as the No. 50. The No. 50 is especially adapted for rapid continuous work, such as assembling, broaching, stamping, die work, and so on, in addition to being admirably fitted for general utility work.

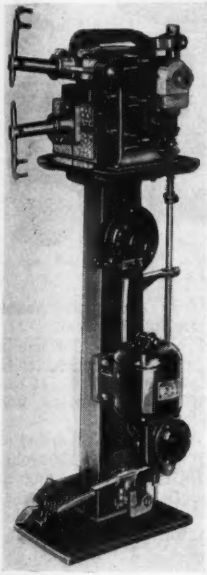
The frame of the press is of semi-steel castings. All pinions are of alloy steel, heat treated, and operate in anti-friction bearings. A ½ h. p. motor, through reductions, drives the ram which is controlled by a friction clutch. Hand or foot controls are optional. A slight pressure on the foot treadle delivers three tons pressure at the bottom of the ram.

The ram travels 11¼ in. in 10 seconds, the stroke being adjustable to from

in. to 11¼ in. Release is instantaneous and the return of the ram is rapid. The press will handle diameters up to 12 inches. The press can be had mounted on a bench or equipped with a stand.

Eisler Variable-Speed Motor-Driven "Speed" Spot Welder

The Eisler Electric Corporation, 770 South 13th Street, Newark, N. J., has added a new series of motor drives to its line of "Speed" spot welders. This new welder, known as the Series "M," is equipped with a variable speed reduction gear head motor that enables the operator to make from 30 to 100 welds per minute in graduated steps. A variable current regulator controls the heat of the weld, while the pressure is adjusted by a pressure nut. The timing is automatic, and is maintained uniform at all speeds. As with other welders in this line, the series "M" is built in six sizes: ½, 1, 3, 5, 10, 20, and 35 k. v. a., and will weld from .0005 in. to ⅝ in. combined thickness.



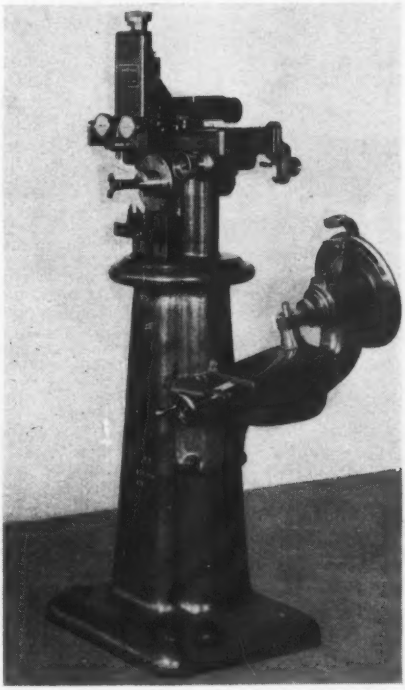
Eisler Variable-Speed Motor-Driven "Speed" Spot Welder.

The principal advantages claimed for this welder are: speed in production, uniform welds, positive and smooth action, simplicity of construction, rugged and compact design, wide range of heating steps, and low maintenance cost.

National - Cleveland Model "B" Gear Checking Machine With Angular Checking Device For Helical Gears

An angular checking device for checking the helix angle of helical gears has been developed by The National Tool Company, West 112th St. and Madison Ave., Cleveland, Ohio. The device is shown attached to a National-Cleveland Model B Gear Checking Machine, although it may also be attached to the Model C machine. The angular checking device may also be furnished as a separate unit to be used as a bench type of measuring machine or mounted on its own pedestal.

As shown in the illustration, the helical gear to be tested is mounted upon a stub shaft that is carried by a slide which is moved to engage the teeth of the gear with the teeth of the rack. The reading of the angle thus established is taken direct from the large diameter drum, which is graduated in degrees. A



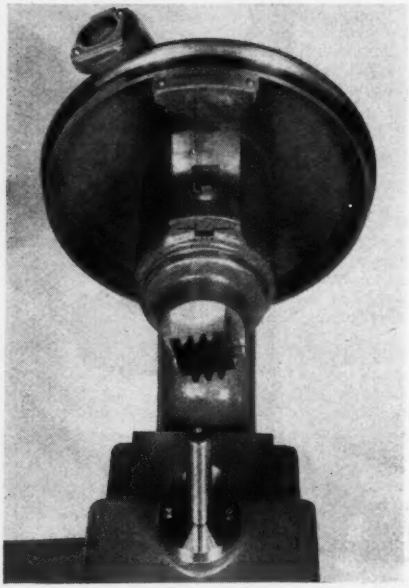
National-Cleveland Model "B" Gear Checking Machine With Angular Checking Device For Helical Gears.

Vernier, graduated to minutes of a degree, is mounted to co-act with the drum so as to enable the operator to quickly determine the angle by visual reading

of the Vernier. A magnifying glass is regularly furnished as part of the equipment.

The rack used in checking corresponds to the normal pitch and tooth elements of the gear to be tested. The device will check right or left hand helical gears with equal speed and accuracy, and the simplicity of the device makes it easy for the average operator to understand and operate. Mounted on its own pedestal, the device may be placed in the production line, where it will permit 100 per cent inspection of the helix angle of gears.

As shown in the illustrations, the device is provided with a slide upon which the gear to be tested is mounted. The slide is moved by means of a screw and nut. In production inspection work, a spring-actuated lever may be substituted for the screw and nut to mesh the



Enlarged View of Checking Device.

gear with the rack and thus speed up the operation. Helical gears being inspected need not be clamped to the stub shaft, hence a minimum amount of time only is required in loading and unloading the work. The device is accurate to 10 seconds of a degree, and may be depended upon.

"U. S." Lathe Grinder

The United States Electrical Tool Co., 2471 West Sixth Street, Cincinnati, Ohio, is now making a grinder that is built for

"U. S." Lathe Grinder

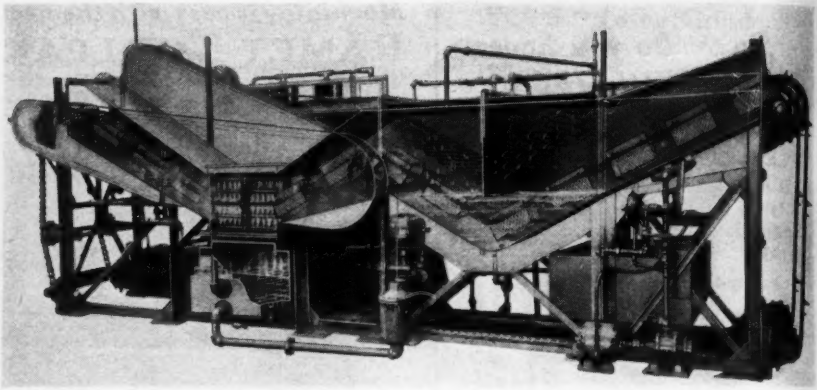
use on lathes with 9-in. or greater swing and having a compound rest. The grinder is intended especially for use in grinding centers, reamers, dies, rolls, small shafts, and similar parts. It can also be used on shapers, planers, and boring mills.

The motor is ¼ h. p. with a speed of 5,200 r. p. m., built for 110 or 220 volts, A. C. or D. C. Ball bearings, rugged construction, and well-balanced distribution of weight are said to assure true, vibrationless operation and long life.

S-M Hot Solvent System for Cleaning Metals

A hot solvent process for cleaning metals and alloys has been placed on the market by the Rex Products & Manfg. Co., 13005 Hillview Ave., Detroit, Mich. The new method, known as the S-M System, makes use of a cleaning liquid called Perm-A-Clor, which is non-explosive and non-inflammable. Perm-A-Clor is said to dissolve oils many times more rapidly than gasoline, kerosene, benzine, oleum spirits, or alcohol, and is claimed to be permanent in quality and acid-free in both liquid and vapor form.

Perm-A-Clor is used in the machine shown in the illustration. The work to be cleaned is placed on a conveyor, upon which it enters a compartment in the



"Rex" Hot Solvent Cleaning Machine.

machine, where it is drenched with a heavy fog of the solvent. The solvent loosens the foreign material and prepares the work for powerful streams of boiling solvent pumped at 35 lb. pressure, which strikes it from all directions. This process removes the dirt and oil and the work then passes along on the conveyor through a compartment where it is rinsed in a bath of distilled hot solvent, after which it leaves the machine clean and dry.

It is stated that Perm-A-Clor is permanent and can be used over and over. The method herein described eliminates blow-offs, driers, and so on, leaving no residue on the surface of the metal to slow up or interfere with subsequent operations such as pickling, plating, enameling, or rust-proofing. The process is recommended by the manufacturers particularly for removing heavy lubricating oils from machined, stamped, or quenched parts, preparing metals for plating, vitreous enameling, painting, or other surface coating, as well as for preparing zinc, aluminum, die-casting and other soft metals which are affected by ordinary alkali cleaners for subsequent operations.

The means for conveying the work through the machine is a matter of adaptation for the task. The machine can be furnished as a single unit, or it may be made to fit into the production line and placed at the point where the operation is needed. The design and construction of the machine is flexible, making it possible to adapt it to time and space.

"T-P" Improved Bench Centers

The Taft-Peirce Manufacturing Co., Woonsocket, R. I., is now marketing the bench centers which were especially designed for use in its own inspection department. The tool has a maximum length between centers of 36 in., and a swing of 8 in.

The bed is constructed of seasoned, close-grained cast iron, with the working surface ground to finish. An accurately-machined T-slot aligns the head and tailstocks, and provides the means for clamping them in position. Adjustable hardened studs at the four corners of the bed provide a method of accurately leveling the bed without the use of shims. A close-fitting key in the T-slot insures accurate alignment.

The centers are hardened and ground tool steel, one fixed and the other retractable. The latter is operated by a lever swung over the top of the tailstock. The special features claimed for the centers are: A heavy beam section which removes all tendency for the bed to spring; use of T-slot reduces bulkiness of

"T-P" Improved Bench Centers

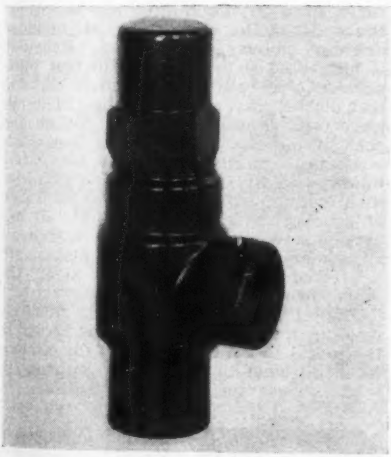
head and tailstocks; adjustable leveling screws, providing quick and accurate method of leveling bed; accuracy of special heat treated centers; location of withdrawing lever on top of tailstock, saving time in placing work.

B & S Pressure Relief Valve

A pressure relief valve designed especially for use with hydraulically-operated machinery has been added to the line of pumps and accessories made by the Brown & Sharpe Mfg. Co., Providence, R. I. The valve is particularly adapted for operation in connection with hydraulic mechanisms and with the No. 53 and 55 rotary geared pumps made by this manufacturer.

By removing the hexagon cap and turning the adjusting screw, the compression on the valve springs may readily be adjusted so that the valve may be set to operate at pressure of from 0 to 200 lb. per sq. in. Guides on the valve prevent fluttering and noisy operation.

Features in the design of the valve are the large valve chamber which provides a ready escapement for the by-passed liquid, and the double spring arrangement



B & S Pressure Relief Valve

which gives wide range and flexibility. These features provide for quiet and efficient operation of the valve, which, when once installed and set for a predetermined pressure, requires no further attention.

Knipson Bench Drill

The "Knipson" Bench Drill shown in the illustration is now being marketed by Ogden R. Adams, 264 State Street, Rochester, N. Y. The machine is simple

Knipson Bench Drill

in design and construction, but efficient on ordinary classes of drilling within its range. The dimension from the center of the spindle to the column is slightly more than 4 in., making it possible to drill to the center of an 8-in. circle.

The maximum dimension from the bottom of the chuck to the table is 7 in., and the maximum dimension from the bottom of the chuck to the base is 10 in. The diameter of the table is 4⅞ in. The capacity of the chuck is $\frac{1}{16}$ in. The table is adjustable, as shown. The spindle is driven by a ¼-in. round belt. Motor recommended, 1/6 h. p. Weight, 15 pounds.

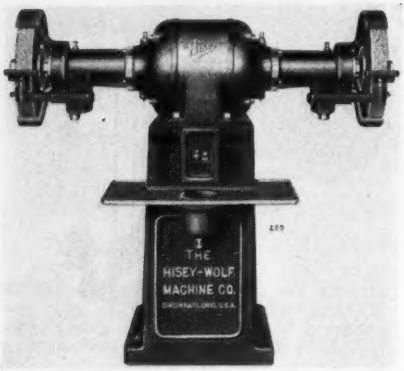
"Hisey" Wide Swing Floor Grinder

The Hisey-Wolf Machine Co., Cincinnati, Ohio, has brought out a line of wide swing floor grinders that are designed especially for the grinding of stove or furnace castings or other large and irregular-shaped pieces. The grinder is made in two sizes, for either direct or alternating current, either 2½ h.p. or 3½ h.p. capacity.

The motor is enclosed in a dust-proof housing and is guaranteed to develop the name-plate horsepower rating for continuous service with a temperature rise not to exceed 40 deg. C. The motor is designed in accordance with A. I. E. E.

standards and is liberally proportioned to withstand momentary heavy overloads (from 75 to 100 per cent above name-plate rating) so common in all grinding operations.

The single phase alternating current machines are equipped with improved commutating-type repulsion induction



"Hisey" Wide Swing Floor Grinder

motors, which have no dragging centrifugal switch. They will start and pick up speed instantly under any load with twice their rated capacity. Starting current is low under all conditions. Low voltage has no effect on the motor used in the Hisey single phase machines.

The two and three-phase alternating current machines are equipped with motors of squirrel cage design, ruggedly built and with a liberal factor of safety and reserve power. Grinders for 60-cycle service are standard; most machines can, however, be supplied to special order for 25, 40, and 50 cycles as listed under each size and type. Direct current machines are equipped with compound-wound motors designed especially for the service. They have large box-type brush holders and oversize commutators with liberal brush area, affording long life.

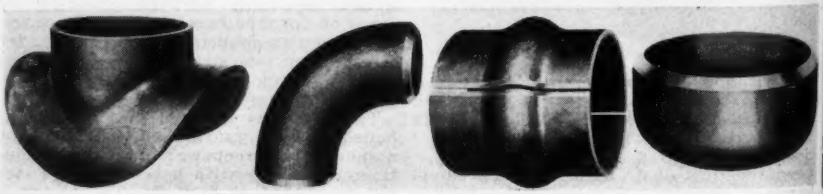
The bearings are high-grade oversize ball bearings, mounted in end caps in closest proximity to the wheels. They are completely enclosed and protected from dust and grit. Timken Roller Bearings, where listed, are optional without extra charge.

The motor starter and switch conform to E. P. C. recommendations. The grinder is furnished complete with approved switch control. Inspection covers on end bell permit full view and access while the machine is in operation.

Midwest Welding Fittings

A complete line of welding fittings, including 90 deg. and 45 deg. ells, welding heads, sleeves, and saddles, has been placed on the market by Midwest Piping & Supply Co., Inc., 1452 S. Second Street, St. Louis, Mo. The outstanding features of Midwest fittings are said to be dimensional accuracy and uniformity. The fittings are made to exact radius and sectional diameter, and in perfect round, all of which are achieved by a special compression sizing operation that has been developed by this firm. Unique fixtures used in machining the bevels on the ends of the ells assure an included angle of exactly 45 or 90 deg. Every ell is subjected to a hydrostatic test pressure 25 per cent greater than the mill test of the corresponding pipe. The ells have tangents that reduce the time and cost of installation, and which make it possible to more quickly and accurately line up the pipe and fitting. One quarter inch of tangent is provided for each inch of pipe diameter; thus an 8-in. ell has tangents two inches long. Each Midwest ell is made from one piece of plate, with a welded longitudinal seam along the inner circumference.

The ellipsoidal form of the Midwest welding head reduces the unit stress in the metal to a minimum, and the circumferential weld to the pipe is entirely in



Left to right—Midwest Welding Saddle, 90-Deg. Ell, Welding Sleeve, and Welding Head.

tension as a result of the long tangent of the head. Therefore, the weld is not subjected to shear or bending stress. The dimensional accuracy, long tangent, and end beveled 45 deg. for welding make for easy application.

The Midwest welding sleeve is used to reinforce a butt line weld between two pieces of pipe and relieve the butt weld of any bending stress and much of the tensile stress to which it would otherwise be subjected. The purpose of the butt weld then becomes principally that of keeping the joint tight. The transverse recess in the sleeve permits the application of the sleeve over the conventional line weld. Each half of the sleeve is slightly less than a semi-circle to assure a snug fit against the pipe.

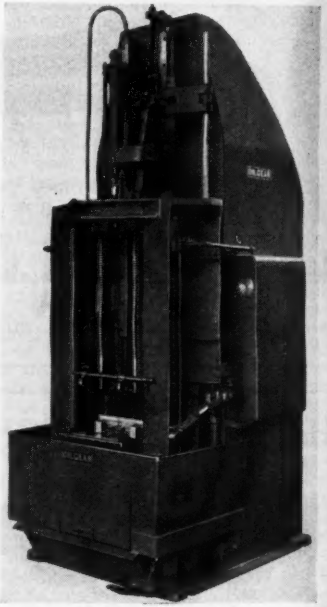
The junction of the neck and body of a welded header has been proved to be a critical point that should be reinforced as strongly as possible. After the neck has been welded to the body in the usual manner, the Midwest welding saddle is slipped down the neck until it fits snugly against the body, where it is welded in place with a heavy bead. The saddle is not intended for tightness; it relieves the weld between the neck and body of the greater part of the tensile, bending, and shearing stresses to which it would otherwise be subjected. Thicknesses of the saddles are varied to suit the pressures and service for which the headers are intended. The saddles are made from firebox steel.

Oilgear "Cyclematic" Vertical Broaching Machine

A vertical broaching machine which, upon the movement of the starting pedal, passes the broach through the work and returns it to the starting position, at the same time indexing the work-table, has been placed on the market by The Oilgear Company, 1400 West Bruce Street, Milwaukee, Wis. The machine, which is called the "Cyclematic," is shown in the illustration.

The machine is powered by the Oilgear pump, which is said to insure a power efficiency of 90 per cent or more at full load and speed. The machine will handle one, two, or three broaching tools simultaneously, permitting rough and finish broaching at the same time or multiple broaching for heavy production. The work lies flat on the table or is clamped in fixtures. The broaching thrust is downward. The loading height is conveniently located at 30 in. from the floor for all lengths of broaching tools.

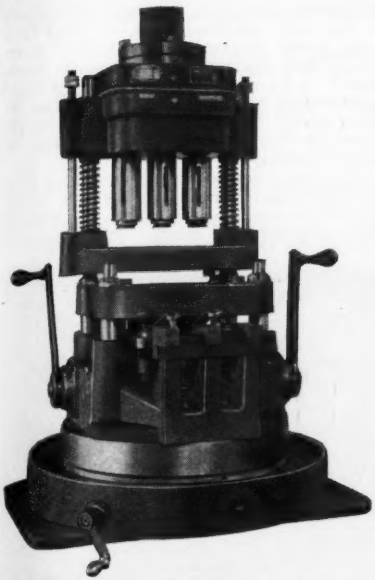
The operation of the machine is controlled through a single lever and the broaches are handled automatically. The broaching tools are secured at both ends during the major portion of the broaching stroke. Lubrication of the tools is positive. The design of the machine is such that the broaching forces and reactions are always parallel and in line with the work. All steps of the machine cycle



Oilgear "Cyclematic" Vertical Broaching Machine.

are positively interlocked so that each must be completed or the machine stops automatically, insuring safety to the operator and tools. A master safety lever is provided, however, which permits stopping the machine at any point in the cycle instantly. It can also be used at any point to reverse action at normal or reduced speed for clearing trouble.

The Cyclematic is made in three sizes. The Type "XM-26" has a normal capacity of 26,000 pounds and a peak capacity of 33,000 pounds, with a maximum stroke of 48 in. and a cutting speed of 18 to 32 ft. per min. The Type "XM-12" has a normal capacity of 12,000 lb., a peak capacity of 15,000 lb., a maximum stroke of



Production Increased From 70 To 300 Pieces

The BUHR Multiple Drilling Equipment, as illustrated, consisting of 3-spindle ball bearing head complete with bushing plate, jigs, and BUHR Ball Bearing Index Table, drills ¾" holes in three pieces at a cycle while loading three more pieces.

Production was increased on this job from 70 pieces to 300 pieces per hour on one machine. One operator serving two equipments now gets 500 pieces per hour from the two machines.

And, have you heard of BUHR'S latest developments such as preloaded ball bearing construction, Micro-locked vertical adjustment in spindles, automatic take-up for wear in spindles, automatic lubrication of all parts, new and advanced adaptation, new and improved adjustable head? These and other improvements will be shown in this column. Watch for them!

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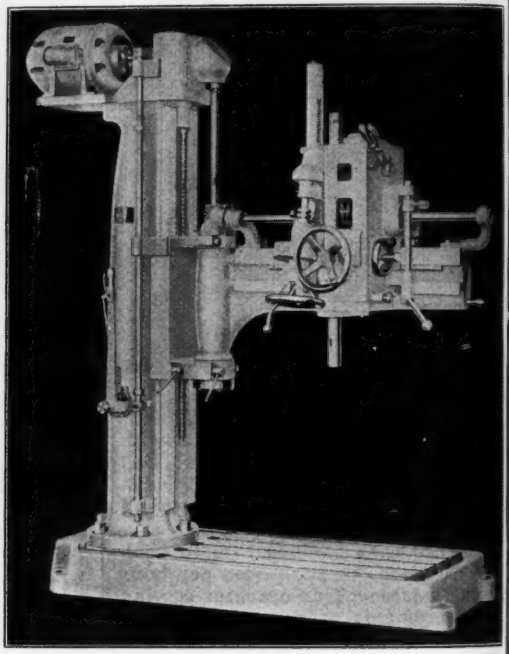
42 in. and a cutting speed of 34 ft. per min. The Type "XM-44" has a normal capacity of 44,000 lb., a peak capacity of 55,000 lb., a maximum stroke of 54 in. and a cutting speed of 29 ft. per minute.

"Western" High Speed Radial Drilling and Tapping Machine

The illustration shows the "Western" High Speed Drilling and Tapping Machine, which has been placed on the market by Western Machine Tool Works, Holland, Michigan. The machine is all-geared, and will run at any speed up to 2,000 r.p.m., which provides for the drilling and tapping of small holes at the proper speeds and efficiency.

The column of the machine is a complete box section, heavily ribbed inside, the only part machined being the ways which hold the saddle. The base is a heavily-ribbed one-piece casting, with ample metal under the five T-slots and with transverse and horizontal ribs of ample proportions to insure permanency of the member. The saddle is hand-scraped to a positive bearing on the column and properly gibbed with adjustable gibs. A square lock-type bearing eliminates any tendency of the arm to lift under any load.

The arm is of double-wall section, making it extremely rigid. Its entire weight is supported by a large ball thrust bearing at the bottom of the lower trunnion. The upper trunnion is provided with a large roller bearing, the rolls of which are maintained in alignment between two ground steel sleeves.



"Western" High Speed Radial Drilling and Tapping Machine.

Six geared spindle speeds, ranging from 300 to 2,000 r.p.m., are instantly controlled in the head by selective sliding gears. The speeds are arranged in geometric progression. Six feeds are available, from .003 in. to .017 in. The feed arrangement is such that the operator can select any of three fine feeds for the small size drills and three coarse feeds for the larger size drills. A hand feed wheel is also provided.

The gears are of chrome nickel steel, heat treated and hardened, and run in oil. Speed reduction from the drive shaft to the feed mechanism is obtained by a steel worm engaging in a bronze worm gear. The feeds may be instantly disengaged by hand or by the automatic depth gage which can be set to trip at any desired point. A small handwheel at the right of the head furnishes means for hand feeding.

The feed friction clutch ring is of large diameter and wide face. It can be engaged or disengaged easily and instantaneously at any point. The maximum of power is transmitted at any spindle speed by Twin Disc clutches, entirely enclosed and running in oil. Centralized control is a feature of the machine, speed and feed changes being controlled in the head and the spindle being controlled by a single lever, located in the head at the right of the operator.

The head is a one-piece casting in which the shafting and gears are located. The head is entirely ball bearing, with 14 ball bearings on the main drive alone. The spindle, which is of crucible

spindle steel, is of large diameter. It is driven by the Western "Low Hung Drive" by which power is applied directly to the spindle at its large diameter.

The elevating mechanism is fully enclosed and runs in a bath of oil. A sliding gear controls the movement of the saddle along the column. Gears are of chrome nickel steel, heat treated and hardened. The mechanism is automatically disengaged at both extreme ends of the saddle traverse. Only one motor (constant speed) is required to furnish power for the entire machine, thus providing for the simplest electrical equipment. The machine is made in the following sizes: 3-ft., 3½-ft., 4-ft., 4½-ft., 5-ft. and 6-ft. The height is 18 feet, and the weight, without motor, is from 3,325 to 4,375 pounds, depending on the size.

Haskins High Speed Tapping Machine

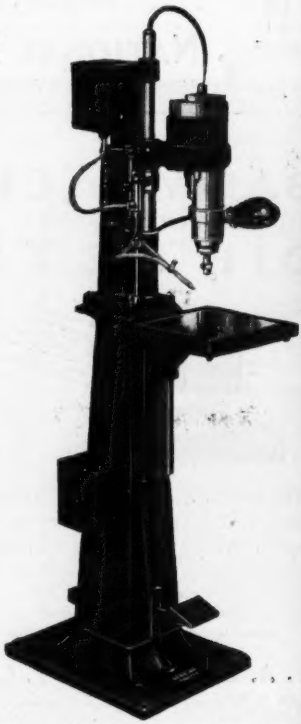
A high speed tapping machine, designed especially to eliminate the breaking of taps, has been announced by R. G. Haskins Co., 4636 West Fulton Street, Chicago, Ill. The tapping head is a self-contained unit, in the construction of which is incorporated a highly sensitive reversing mechanism that operates at high speed. The unit is readily removed from the machine with the rigid two-piece aluminum housing in which it is enclosed. Ball bearings are used throughout except on the chromium-plated collet shaft, which operates in an amply-lubricated hardened and lapped alloy steel bushing.

The tap is held by a collet chuck that accurately centers it and drives it by the square shank. The chuck is small in diameter and weight in order to minimize the inertia effect. A sufficient number of collets to take taps from No. 2 to No. 14, inclusive, are furnished.

The machine is regularly furnished with gears for any two of the following standard tapping speeds: 1500, 1750, 2333, and 3062 r.p.m. Special gears can be furnished for tapping speeds of 2130, 2676, 3500, and 4000 r.p.m. The reverse speed is twice that of the tapping speed. The gears can quickly be changed by loosening the wedge lock and removing the tapping unit from the motor housing.

The high speed of the taps makes it imperative that a suitable lubricant be used, which is supplied in the right amount and at the correct time and place by means of an efficient pump. The pump operates automatically, is simple in construction, dependable in action, and is adjustably mounted on the left side of the machine frame. The supply is regulated by a conveniently-located adjusting screw.

Ample power is provided by a motor of the repulsion-induction type, which operates at a moderate and constant speed. The motor bearings are of the combined radial and thrust ball type. The bearings and gears are grease packed and require little attention. The start and stop switch is conveniently located.



Haskins High Speed Tapping Machine

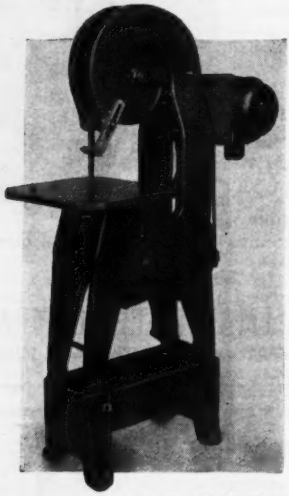
The machine frame is a substantial iron casting, accurately machined. The tapping unit is held in a rigid split ring arm that is secured to the ground-finished hollow vertical shaft, which is connected to the foot treadle. The vertical shaft slides in two long bearings that are accurately bored and lapped to alignment. The arm that holds the tapping unit has both vertical and sidewise

adjustment and is secured by a wedge lock. The tapping unit is counterbalanced and quick return to the tapping head is provided by a suitable spring. Stops are provided for locating and limiting the vertical travel. An adjustable light, attached to the frame, provides illumination.

The foot treadle is so designed that the tap can establish its own lead without danger of stripping the thread or breaking the tap. The machine can be furnished with a pedestal base, as shown, or arranged for bench installation. The tapping capacity is ¼ in. in brass and ⅛ in. in steel. Finish is crystalline baked varnish, natural aluminum, and nickel plate.

Grob Type A-2 Continuous Filing Machine

A floor type continuous band filing machine, known as the Type A-2 and shown in the illustration, has been placed on the market by Grob Brothers, S. 97th Street and National Avenue, West Allis, Wis. The machine is designed for speed and accuracy in the filing and lapping of punches, dies, and miscellaneous parts.



Grob Type A-2 Continuous Filing Machine

The frame of the machine consists of two side members, bolted together by distant studs and mounted on a heavy base which also serves as a container for chips. The lower portion of the side members is spaced wide enough to allow for the driving mechanism. The upper portion is spaced closer to provide protection to the operator from the revolving chain and to increase visibility of the work piece.

The file-chain operates over two sheaves approximately 13 in. in diameter which, with the reduction drive pulley, are mounted on ball bearings. Positive drive to the chain is obtained through a series of equally-spaced drive pins mounted in the lower sheave and matching with the links of the chain. The drive-pins are located in the center of the groove in which the chain operates and are cushioned by helical springs so that they can adjust themselves properly to the links of the chain.

Proper tension on the file-chain is obtained through a hand wheel at the right side of the machine, which actuates the upper sheave through a hinged bracket. The hand wheel is cushioned by a helical spring, and an adjustable pin mounted on the frame of the machine close to the spring acts as a stop against the hand wheel as soon as the spring is properly compressed. This arrangement prevents over-tightening of the chain.

The replaceable back-support over which the files slide is hardened and ground. The files are guided against the surface of the back-support by means of a roller covered with a special, tough but flexible rubber. The roller is secured to a shaft which is mounted on ball bearings to an arm adjustable in height.

The tiltable work table is 17 x 21 in. in size. The table is 39 in. above the floor and the space between the surface of the table and the frame is 7¼ in. The overall height of the machine is 63 in., and the base is 15 x 24 in. The machine is equipped with a ¼ h. p. ball bearing motor. Weight, uncrated, 500 pounds.

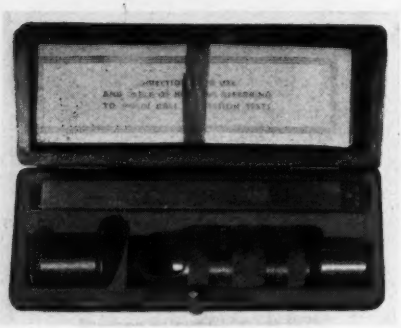
Poldi Ball Impression Hardness Testing Apparatus

Tests on metals for hardness can now be made anywhere, on any size piece, and practically under any conditions, by the use of a "pocket" testing outfit that has been placed on the market by the Poldi Steel Corporation of America, 247 West 18th Street, New York, N. Y. The complete apparatus is enclosed in a small case that measures 6¾ x 2½ x 1½ in. and weighs about 1¼ pounds.

The hardness of the material is determined by a ball impression test with

which the Brinell table of hardness numerals is used. A hardened steel ball of 10 mm. (approx. 25/64 in.) diameter is pressed into the piece to be tested and at the same time into a standard steel rod of a known tensile strength. Impressions are made by the ball both in the work and in the standard steel rod. The diameters of the impressions are measured in millimeters by means of a magnifying glass that is supplied with the apparatus, and the tensile strength of the work as well as the Brinell hardness numeral are determined by referring to a table of numerals.

The apparatus consists of a knurled sleeve in which the punch and ball are held, a standard steel rod, and a magnifying glass especially adapted for this purpose, all held in a compact case. To use, the standard steel rod is inserted through the opening in the sleeve, between the ball and the punch. Actuated by a spring in the sleeve, the punch presses the standard steel rod firmly against the ball. A flat, clean surface is

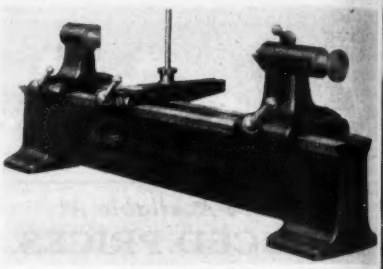


Poldi Ball Impression Hardness Testing Apparatus.

ground or filed on the surface to be tested, then the apparatus, fitted with the rod, is held vertically on the test surface and a blow is struck on the punch with the hammer. Except for very high alloy steels, such as 25 per cent nickel, 14 per cent manganese, and so on, this method may be used for all kinds of malleable iron and steel in the same manner as the Brinell ball impression test method.

Barber-Colman Bench Center

A dependable, carefully-made bench center has been announced by Barber-Colman Company, Rockford, Ill. The center is intended for use in the inspection of circular, cylindrical, and such other work as can be held on arbors and such pieces as shafts, pinion shafts, plugs, and other work that can be held between centers. The center may also be



Barber-Colman Bench Center

used for determining the parallelism of keyways with regard to the axis of a shaft, or eccentricity.

The bed is of ribbed box construction with scraped dovetail ways. The head and tailstocks are independently adjustable, and each is fitted with a hardened and ground steel center. The tailstock has a spring-loaded center which may be clamped in position. The slide, or indicator base, is provided with a vertical post which may be moved to any position in or out between centers, and is intended for use in holding a dial indicator. Other types of indicator holders are easily attached to the bench center by means of a bolt in the tee-slot in the slide. All moveable parts are easily locked in place by ball handles on the main parts and by a fluted nut on the indicator post.

Correction

In an item in the December, 1931, issue of Modern Machine Shop in which the Keller "right and left attachment" was described, the address was given as 8[illegible] Front Street, Brooklyn, N. Y. Inasmuch as the plant and business of the Keller Mechanical Engineering Corporation have been purchased by the Pratt & Whitney Company of Hartford, Conn., all inquiries regarding this attachment should be sent to the latter address.

For Your Catalog Library

Check any of these useful publications that you want, write your name, firm name, title, and address on the margin, then tear out the page and send to Modern Machine Shop, 128 Opera Place, Cincinnati, Ohio. They will be forwarded to you promptly without cost or obligation. Please restrict your list to not more than ten.

Ames Gages: Catalog No. 50, issued by the B. C. Ames Company, Waltham, Mass., contains complete descriptions and illustrations of the dial gages, gage heads, upright gages, cylinder gages, dial micrometers, and precision verifiers, special gages and attachments made by this company. Copy free upon request.

Scraping By Power: Bearing surfaces can now be scraped with a power scraper that is quicker and easier than the old-fashioned hand method. The tool is described in a folder that is issued by Anderson Bros. Mfg. Co., 1926 Kishwaukee St., Rockford, Ill. Sent free on request.

Stop Tap Breakage: A booklet that tells how to stop the breakage of taps, reamers, and other tools, by the use of a friction chuck, also how to use the chuck for setting studs or nuts, has been issued by The Apex Machine & Tool Co., 200 Davis Avenue, Dayton, Ohio. Sent free upon request.

Machine Shop Accessories: Catalog B-27, issued by the Armstrong Bros. Tool Co., 328 N. Francisco Ave., Chicago, Ill., describes the line of tool holders, boring tools, wrenches, pipe tools, ratchet drills, lathe dogs, and other tools manufactured by this company.

Hold Odd-Shaped Pieces Securely: A vise in which odd-shaped work can be held securely without the need of special jaws or fixtures is described in a folder that has been issued by The Avey Drilling Machine Co., P. O. Box 487, Cincinnati, Ohio. Copy free upon request.

Hobs and Milling Cutters: A complete line of milling cutters and hobs for cutting all kinds of gears, splines, sprockets and other forms is described in Catalog G, issued by the Barber-Colman Company, Rockford, Ill. Descriptions and illustrations of the Barber-Colman hobbing machine and hob-sharpening machines are included. Sent free on request.

Greenerd Arbor Presses: Catalog No. 36, issued by the Edwin E. Bartlett Co., Nashua, N. H., describes and illustrates all the various types and sizes of arbor presses made by this firm. Copy free upon request.

Automatic Oiled Die Sets: The automatic oiled die sets, die shoes, punch holders, leader pins, bolster plates, bushings, and other standard die parts made by the E. A. Baumbach Manfg. Co., 1806 S. Kilbourn Ave., Chicago, Ill., are described in Catalog No. 5, which has been issued by that company. Sent free upon request.

Portable Flexible-Shaft Machines: Flexible-shaft machines of the latest design and built for heavy duty service are described in Circular No. 50, issued by The Binghamton Flexible Shaft Co., Maple Avenue, Johnson City, N. Y. Copy free upon request.

Buhr Multiple Drilling Equipment: Increase your production with a mutiple spindle head, fixture, and index table built as a single unit. Write for information to Buhr Machine Tool Co., Davis & Greene Streets, Ann Arbor, Michigan.

Mounted Grinding Wheels for use in small holes such as are found in bushings, dies, gears, tools, etc., are described in a catalog that has been issued by the Chicago Wheel & Manfg. Co., 110 S. Aberdeen St., Chicago, Ill. Copy free upon request.

Motorize Your Cone Pulley Lathes: An attachment that can be applied to your lathe with four bolts makes it possible to motorize and modernize your lathes. Write for information to Cullman Wheel Co., 1336 Altgeld St., Chicago, Ill.

Gears Of All Kinds are described and illustrated, with specifications, in Catalog 80, which has been issued by the Chicago Gear Works, 105-9 S. Jefferson St., Chicago, Ill.

Grinding Wheel Dressers: All of the different types of grinding wheel dressers made by the Desmond-Stephan Mfg. Co., Urbana, Ohio, including Desmond-Huntington, Desmond-Sherman, Zig-Zag, Diamo-Carbo, and diamond dressers, are described and illustrated in a catalog that has been published by the firm mentioned. Free upon request.

Precision Grinding: A booklet which describes and illustrates the most modern methods of performing **all kinds of precision grinding operations, showing how the Dumore grinder can be applied to various kinds of machine tools, has been published by The Dumore Company, Racine, Wis. Copy free upon request.**

Interchangeable High Production Tools: Catalog No. 28 issued free by the Eclipse Counterbore Co., 7410 St. Aubin St., Detroit, Mich., describes and illustrates the interchangeable counterbores, spot facers, end form cutters, and other end cutting tools made by this firm.

"Speed" Spot Welders for welding metals from 0.0005 in. to 5/8 in. thick are described in a catalog that can be had by addressing Elsler Electric Corp., 761 South 13th Street, Newark, N. J.

Precision Measuring Instruments: The latest types and models of dial indicators, thread lead test gages, pitch gages, thickness gages, dial comparators, and other precision measuring instruments marketed by the Federal Products Corporation, Providence, R. I., are described and illustrated in a book that will be sent free upon application to this firm.

The Involute Gear Simply Explained: A direct, clear explanation of the theory and principles of involute gearing without the use of higher mathematics can be obtained without charge by addressing The Fellows Gear Shaper Co., 78 River St., Springfield, Vt.

Questions To Ask Before Buying a Jig-Boring Machine: A list of the fine points to look for in a jig-boring machine, with descriptions and illustrations of the working parts of the Swiss Jig Borer, can be obtained free by addressing The R. Y. Ferner Co., 1511 K St., N. W., Washington, D. C.

Tungsten-Carbide Tipped Tools: The boring tools, counterbores, form cutters, facing heads, reamers, spot-facers, and other tools made by The Gairing Tool Co., 1629 West Lafayette Blvd., Detroit, Mich., made with or without tungsten-carbide tips, are described and illustrated in Catalog No. 20. Copy free upon request.

Ball and Roller Bearings, either journal or thrust, for all purposes and in all sizes, are described and illustrated in catalog No. 9 which has been issued by The Gwilliam Company, 360 Furman Street, Brooklyn, N. Y. Copy free upon request.

Dynamic and Static Balance: Full information as to what static and dynamic balance means, the necessity for correct balance in rotating parts, methods of discovering and correcting unbalance, and the uses of balancing equipment can be had without charge by addressing Globe Tool & Engineering Co., Dayton, Ohio.

Swiss Files: The complete line of Grobet Swiss Files for use in die and tool work or for other fine work is described and illustrated in Catalog "K," published by the Grobet File Corporation of America, 3 Park Place, New York, N. Y. Copy free upon request.

Precision Bench Lathe Work can only be done on finely-built, accurate machines. The complete line of Hjorth Precision Bench Lathes is described and illustrated in a catalog that has been issued by Hjorth Lathe & Tool Company, 60 State Street, Boston, Mass. Copy free upon request.

Threading Machinery: Catalog No. 32, containing full descriptions of Landis threading machines, stay bolt threading machines, bolt factory threading machines, automatic forming and threading machines and chaser grinders can be had without charge by addressing Landis Machine Co., Inc., Waynesboro, Penna.

Air-Operated Work-Holding Devices: A booklet showing how air-operated chucks and devices of various kinds can be applied to different kinds of machines to save time and labor has been issued by The Logansport Machine Co., Logansport, Ind.

Save Your Diamonds by using the Diamond Point Angle Tool. Write for information to Mendes Cutting Factories, Inc., Charlevoix Bldg., Detroit, Mich., or 105 West 40th Street, New York, N. Y.

M-C Pinion Rod, made by the Meisselbach-Catucci Mfg. Co., 70 Stanton St., Newark, N. J., insures economy and accuracy in cut pinions. Send for information.

Installation and Maintenance of Lathes: A newly compiled booklet showing proper methods of installing, leveling and maintaining Monarch Lathes. It is useful information for every lathe user. Mailed free. Address The Monarch Machine Tool Company, Sidney, Ohio.

Compound Spot-Facing Tool: A spot-facing tool retracting, serrated roughing cutters and fixed finishing cutters in the same tool will break up the scale easily and do accurate work. Write for bulletin to Mummert-Dixon Co., 120 Philadelphia St., Hanover, Penna.

"The Birth of a Notion," published by the National Boring Tool Co., 8619 Mack Avenue, Detroit, Michigan, describes the design, construction, and use of a ball-bearing rotary jig and pilot bushing. Copy free upon request.

"The Answer to Your Gear Problems": Information as to correct methods of cutting and finishing gears will be supplied without charge by The National Tool Co., Cleveland, Ohio. This firm also carries a complete stock of gear shaper cutters and markets the National-Cleveland Spur and Helical Gear Grinding Machine.

Ball and Roller Bearing Data Sheets: A complete set of data sheets showing all the dimensions and loads at given speeds, and giving instructions for mounting precision ball bearing and Hoffmann roller bearings, can be obtained without charge by addressing the Norma-Hoffmann Bearings Corporation, Stamford, Conn.

"Commercial Lapping for Close Limits and High Production" is the title of a booklet that discusses hand and machine lapping, types of lapping tools and machines, workholders for machines, preparation of laps, preparation of work for lapping and other important points. A copy may be had by addressing Norton Company, Worcester, Mass.

"Fastenings" is the title of a booklet, issued by the Parker-Kalon Corporation, 192-196 Varick Street, New York, N. Y., in which are included the results of surveys made in fourteen different plants as to the efficiency of fastening methods. Copy free upon request.

O-C Standardized Fixture Units in 677 sizes and 5 styles are described and illustrated in the Engineering Book put out by A. H. Pearson, 7 E. Grand Ave., Detroit, Mich. Copy free upon request.

Runde Offset Boring Heads: Eccentric Boring Heads, precision-made, with a minimum of overhang and a maximum boring range, to fit all standard spindles, are described and illustrated in a circular that can be had by addressing Progessive Tool Co., 419 Hendrie Street, Detroit, Michigan.

"Ramet" Cutting Metal: A new cutting metal that is said to cut alloy steels, manganese steel, or any other metal composition, is described in a folder that will be sent free upon application to the Ramet Corporation of America, North Chicago, Ill.

Shape or Slot With This Machine: The Rhodes Convertible Shaper, made by The Rhodes Manfg. Co., Waltham, Mass., can be used for horizontal shaping or vertical slotting. Details upon request.

Bench Lathe Mounting and Driving Equipment: Bulletin 120-A, issued by Rivett Lathe and Grinder Corporation, Brighton, Mass., contains complete descriptions and illustrations of modern and conventional countershaft, individual motor drive jackshaft, and speed box motor drive, also benches, cabinets, oil pans, etc. Copy free upon request.

Fulimore Industrial Clutch: A multiple disc clutch, made in two types, to run in oil or dry, and which is so built that it can be operated at high speeds, is illustrated and described in a folder that will be sent free by the Rockford Drilling Machine Company, Rockford, Ill.

Automatic Lubrication: Individually motor-driven pumps that keep the work flooded with lubricant are described in a booklet that has been published by the Ruthman Machinery Co., Front and Pike Sts., Cincinnati, Ohio.

Stamp Your Name on Your Product: Full information as to the steel roller dies, embossing dies, and embossing rolls made by the Schwerdtle Stamp Co., 10 Cannon Street, Bridgeport, Conn., can be obtained by writing this firm.

Push-Broaching With Modern Equipment: Modern methods of finishing holes by push-broaching are described in a booklet that is issued free by the Sheldon Machine Co., 3255 Cottage Grove Ave., Chicago, Ill.

Economies in Material Handling: A volume of facts about planned load handling, with actual examples of economies in time, material, and labor costs that have been effected with Shepard electric hoists will be sent free upon request to Shepard-Niles Crane & Hoist Corp., 424 Schuyler Avenue, Montour Falls, N. Y.

Rapid Drill Jigs: How time can be saved and drilling operations made easier by the use of a quick-acting drill jig is told in a booklet that is issued free by the Siewek Tool & Die Co., 10230 Woodward Ave., Detroit, Michigan.

Simonds Files: A useful book on files showing the various styles made, their uses, cross-section, and cuts, and containing a number of reference tables and other information useful in a machine shop can be had by addressing Advertising Dept., Simonds Saw & Steel Co., 470 Main Street, Fitchburg, Mass.

The Most Efficient Speed for the operation of special production units, power conveyors, and other machinery by the use of the WHS Speed Reducer and how it can be obtained is told in a bulletin that will be mailed free by Winfield H. Smith, Inc., 30 Eaton St., Springville, N. Y.

Speed and Accuracy In Straightening: The Springfield Straightening Press is an ideal tool for use in straightening any length or size of rough or finished work. Send for illustrated folder. Address The Springfield Machine Tool Co., 630 West Southern Avenue, Springfield, Ohio.

Cutting and Grinding Facts: A discussion of cutting oils and lubricants, together with descriptions and illustrations of various kinds of jobs upon which cutting oils are used, is contained in a booklet that is issued by the Sun Oil Company, 1608 Walnut Street, Philadelphia, Penna. Free upon request.

Rigidmilling Principles and Practice: A book that shows how the Rigidmil can be adapted to various kinds of usual and unusual milling operations, and which describes in detail the work that can be handled by this machine has been issued by the Sundstrand Machine Tool Co., Rockford, Ill. Copy free upon request.

Chuck With Air: How time and labor can be saved by the use of air-operated chucks, cylinders, and other equipment is told in a book which describes "Hopkins" Air-Operated Equipment. Published by The Tomkins-Johnson Company, 620 N. Mechanic St., Jackson, Mich. Sent free upon request.

Change drilling speeds instantly without stopping the machine or touching a belt. This can be done with the Victor Super-Drill, made by U. S. Automatic Bor Machinery Co., Newtonville, Boston, Mass. Bulletin free upon request.

Electrically-Driven Portable Tools: The "U. S." line of electric drills, die grinders, electric screw drivers, surface grinders, tool post grinders, and bench and floor grinders is described in Catalog No. 29, which has been published by The United States Electrical Tool Co., 2471 W. Sixth St., Cincinnati, Ohio.

Better and Faster Finishing: Finishing and polishing operations can be performed easier, better, and faster with the Simplex-M Abrasive Band Grinder, marketed by Walls Sales Corp., 96 Warren Street, New York, N. Y. Write for illustrated circular.

Change Punches Without Removing Die: The user of Hercules Interchangeable Punches and Retainers can change punches without removing the die from the press. Information that will help to lower die-building costs, reduce lost time for repairs, and increase press production can be had by addressing Whitman & Barnes, Inc., Detroit, Michigan.

By GEO. ALEXANDER MANN

Opportunity knocks once — the installment collector ever after.

Supposin' the stuff we're drinkin' is slow poison—who's in a hurry?

Poor Dad

"Dad will pay for our honeymoon,
Don't you think he's clever?"
"He sure is," the groom replied,
"We'll make it last forever."

'Tis said our ancestors sprang from ferocious beasts of the jungle. Well—you can't blame 'em for that.

You Said It

With fountain pens and lighters,
Tell yuh what it means,
A pocket fulla pencils
An' matches in your jeans.

You can't blame the salesmen for hesitating when the boss tells 'em to go after business — they all know where it's gone.

Too Troo

"Twenty miles to a gal."
Is what made us surrender,
But the best that we get
Is eight miles to a fender.

Nex' Election Day they're goin' to have to show their stuff before we do ours.

Before graduation the college stude is fired with ambition — afterwards with enthusiasm.

Gandhi says: "Man loses his freedom through his own weakness." Huh —guess it serves him right for marryin' her.

New Supply On the Way

"The flies in here are awful"
(His voice was filled with sorrow)
The waiter said, "Don't worry, sir,
There'll be some more tomorrow."

Proof of a man's thrift useta be a bank account—now it's an extra shirt.

'Twould seem that the only one who ever took disarmament seriously was Venus de Milo.

The average specialist has to have all your teeth pulled before he can give you a thorough examination.

Aw Hush

A "miniature" cocktail
Will put you to rout;
One little drink,
In a miniature out.

The next Congress may be evenly balanced, but how about the Congressmen?